Museum Victoria Science Reports 29: 1–49 (2024)
ISSN 1833-0290
https://museumsvictoria.com.au/collections-research/journals/museum-victoria-science-reports/
DOI https://doi.org/10.24199/j.mvsr.2024.29

Catalogue of the Cirripedia (barnacles, phylum Arthropoda) collected by the IN2021_V04 and IN2022_V08 expeditions to the Australian Christmas Island and Cocos (Keeling) Islands Territories

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Abstract In this catalogue, the 40 species of barnacles collected by the IN2021_V04 and IN2022_V08 expeditions to the Australian Christmas Island and Cocos (Keeling) Islands Territories are diagnosed and illustrated.

Andrew M. Hosie. 2024. Catalogue of the Cirripedia (barnacles, phylum Arthropoda) collected by the IN2021_V04 and IN2022_V08 expeditions to the Australian Christmas Island and Cocos (Keeling) Islands Territories. *Museum Victoria Science Reports* 29: 1–49
https://doi.org/10.24199/j.mvsr.2024.29

Keywords barnacles, crustacea, Indian Ocean Territories, illustrated catalogue, biodiversity, species discovery, deep-sea

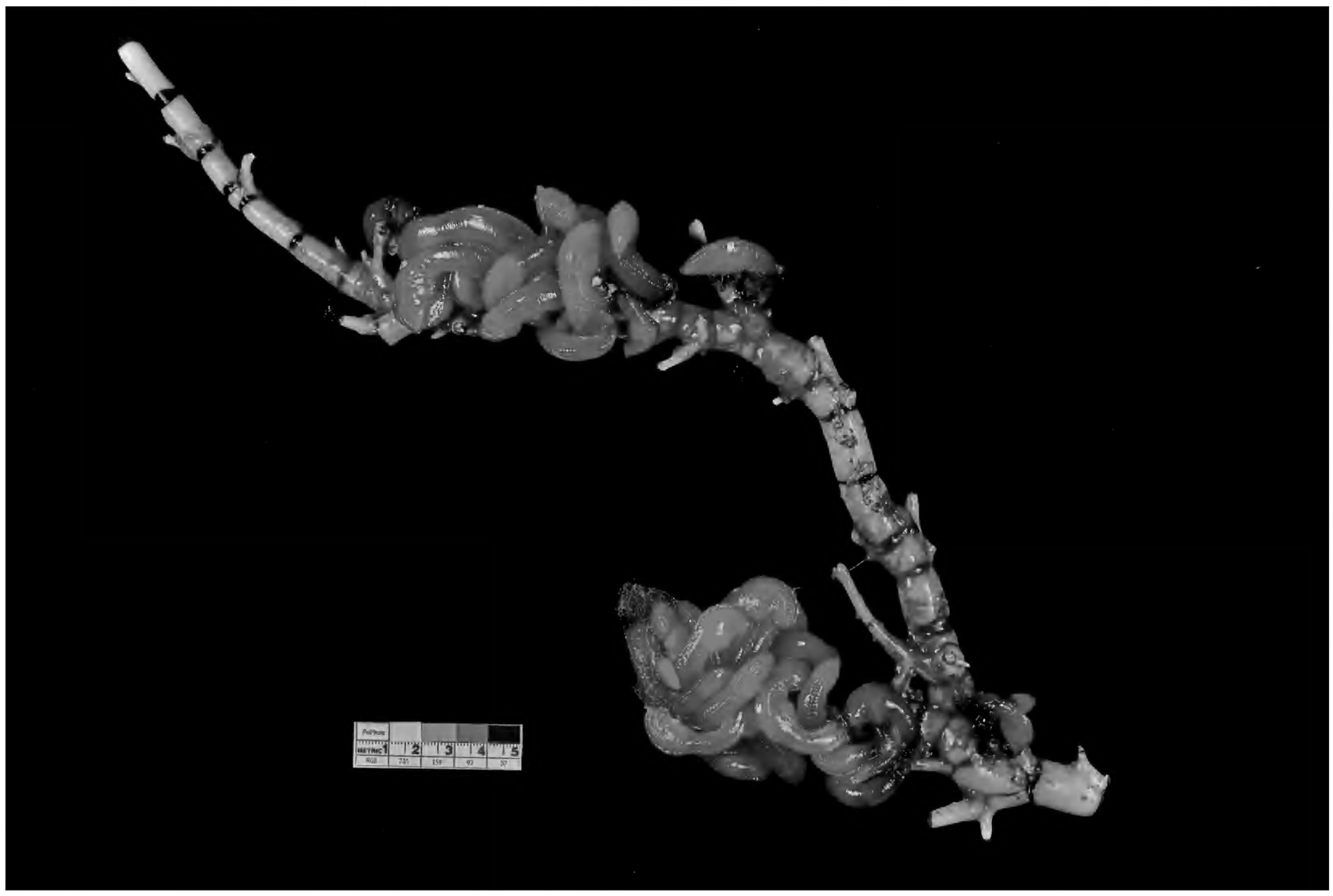

Figure 1. *Heteralepas* spp.

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Introduction

This catalogue documents the thoracic Cirripedia (barnacles, phylum Arthropoda) collected by the IN2021_V04 and IN2022_V08 expeditions to the Australian Indian Ocean Territories (IOT) of Christmas Island and Cocos (Keeling) Islands and includes 40 taxa that can be identified to species-level. Previous studies on cirripedes from this area have solely focussed on intertidal or shallow water collections from the islands (Jones, 1994), making this catalogue the first records of these species within the IOT.

This century has seen a series of phylogenetic analyses targeting various aspects of barnacle diversity, which has recently culminated in a significant rearrangement of the taxonomy at the family-level and above (see Chan *et al.*, 2021). While this revision aligned families with current phylogenetic patterns, the authors recognise that there is likely to be more rearrangement within families to come, particularly in the large, predominantly deep-sea family Scalpellidae. Within almost all barnacle families, there are groups of genera in need of critical review, and, within species, molecular data is revealing significant diversity with an abundance of species-complexes and cryptic species (Hosie *et al.*, 2021; Lin *et al.*, 2015, 2020). While molecular data is steadily growing for barnacles, deep-water species are underrepresented on DNA databases such as GenBank and the Barcode of Life. As such, sequencing representatives from this collection to facilitate molecular identifications is underway and will be published within more detailed taxonomic accounts.

Methods

Station details and collection methods are described in O'Hara (2024).

The specimens from these expeditions have been identified primarily using morphological characters as set out in the keys presented by Zevina (1981, 1982) and Young (1998, 2002) with comparison back to primary and more recent literature. The diagnoses given here are intended as a guide and it is recommended to refer to the texts cited herein for further comparison. Diagrams and explanations of morphology and anatomy can be found in Foster (1978) and Chan *et al.* (2009).

Systematic account

Order Balanomorpha

Family Balanidae

Megabalanus **sp.**

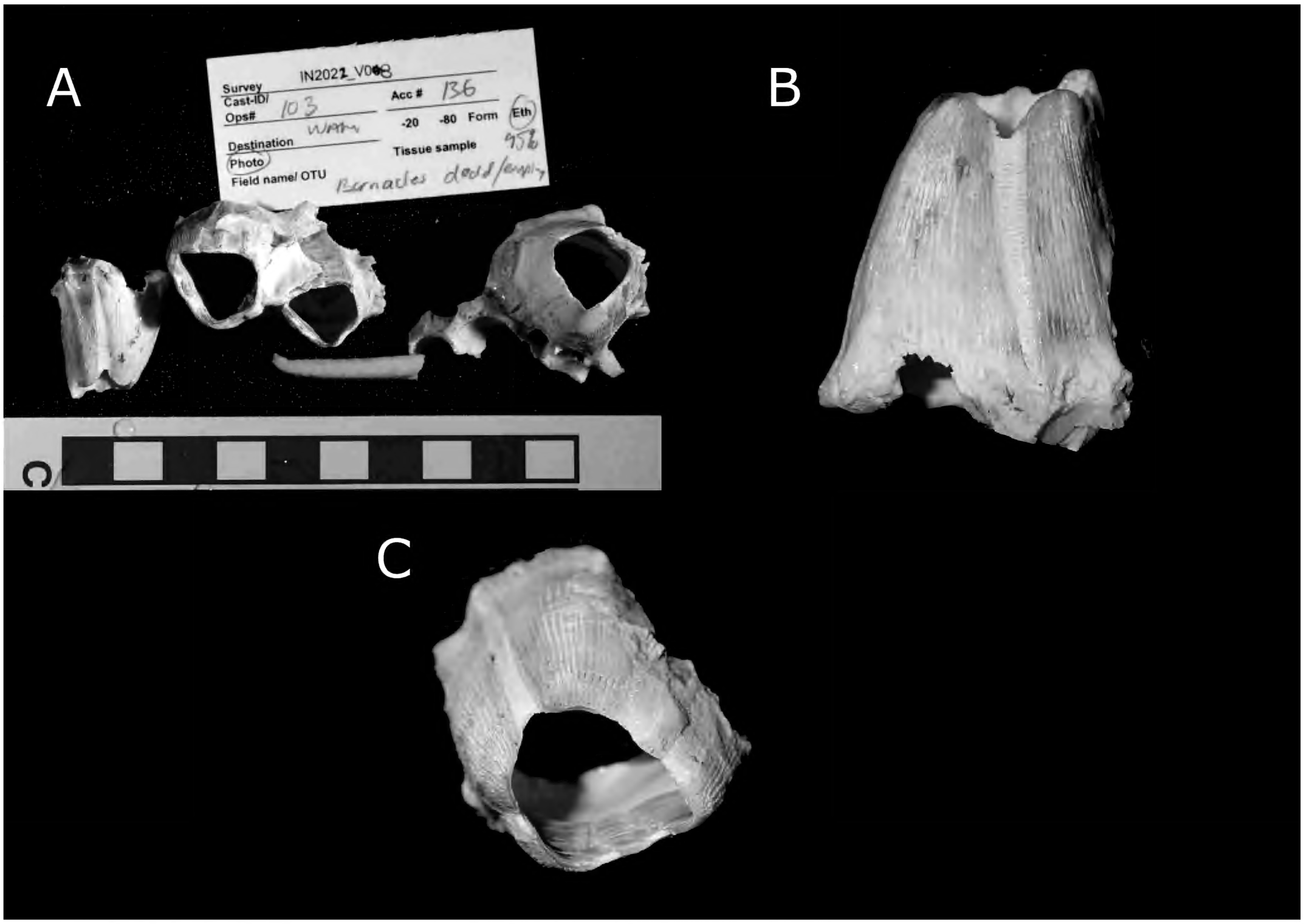

Figure 2. Empty shells of *Megabalanus* sp. WAM C82257 (Op 103) (A) group of four whole shells, (B) lateral and (C) top-down view of individual.

Diagnosis Shell large and robust, wall with six plates. Wall plates with single row of longitudinal tubes. Radii summits almost level with horizontal ridges, sutural edges with evenly spaced denticles on upper and lower margin of sutural teeth.

Taxonomic remarks These specimens were dead at the time of collection and only the outer shell walls were present. As such it is impossible to identify to species with any certainty and has been included in this catalogue as the only representatives of the genus collected. This genus is represented by shallow water species found in the intertidal to ∼50 m. The smoothness of the basis indicate they were once attached to an artificial surface. Add to this the depth and distance to the nearest landmass that these specimens were purportedly collected suggest they had been dislodged from a ship's hull. Records of this genus at Cocos (Keeling) and Christmas Islands are few but include *M. tintinnabulum* and *M. occator*. The present shells more closely resemble the former species.

Distribution IOT records 3510–3611 m.

Ecology and life history Members of this genus are very commonly found attached to vessel hulls and a key component to fouling communities in and around ports globally. As such many species have been considered invasive in various parts of the world.

Solidobalanus hawaiensis **(Pilsbry, 1916)**

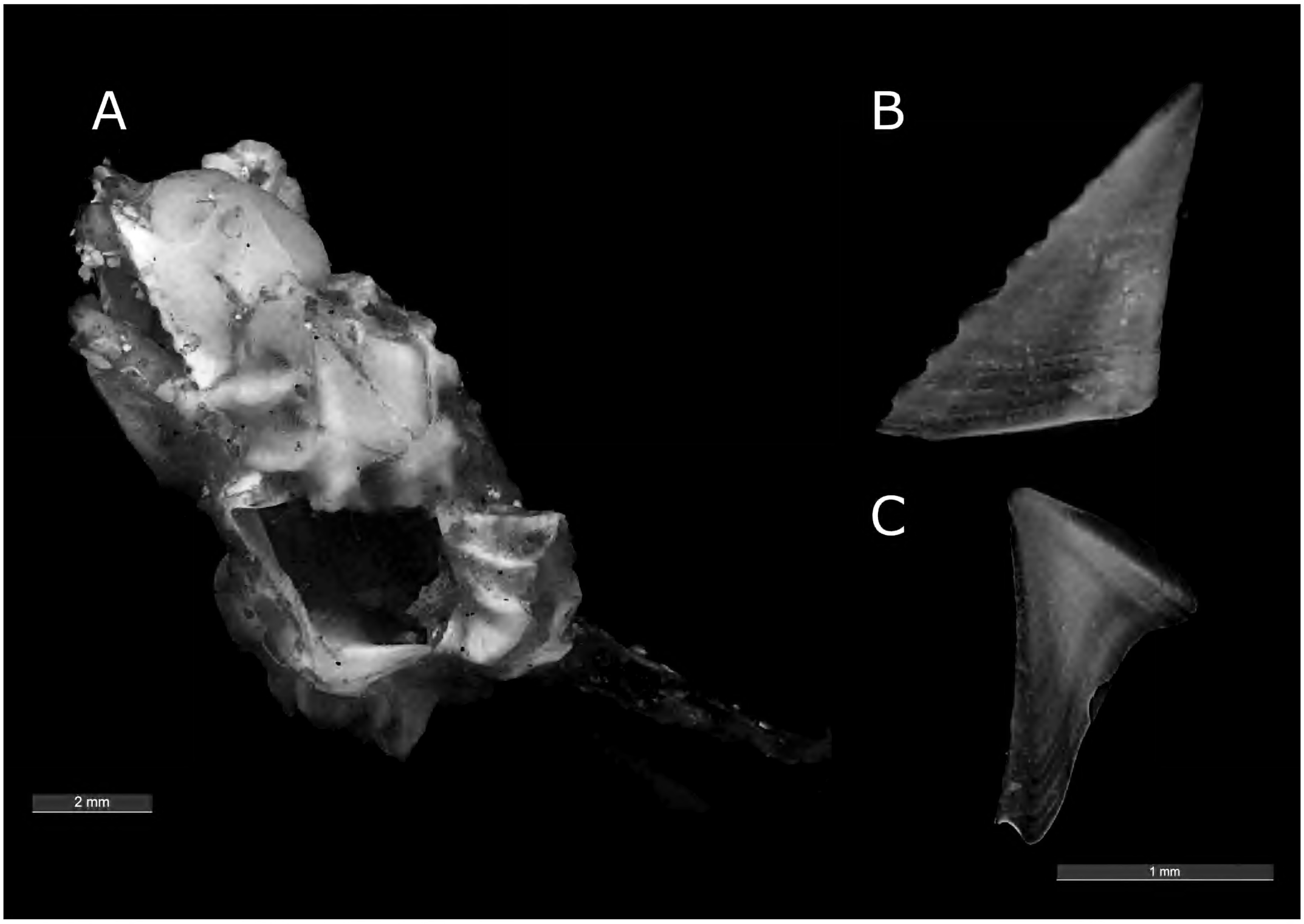

Figure 3. *Solidobalanus hawaiensis*. (A) cluster of specimens attached to gorgonian skeleton, external views of (B) right scutum and (C) tergum (WAM C80013, Op 172).

Diagnosis Shell wall with six white, solid plates, radii reddish orange. Parietes with external longitudinal ribs, rostrum with two or three, rostrolateral and carina with two, carinolateral with one. Internally plates with numerous longitudinal ridges reaching base. Opercular plates with fine growth lines. Tergum relatively narrow with adductor muscle crests confined to near basal-carinal angle, spur short, less than own width from scutal margin. Scutum with narrow articular groove and low articular ridge.

Taxonomic remarks The IOT specimens are the first records for this species from the Indian Ocean. The prominent ribbing on the parietes and narrow tergum serve to separate this species from *S. pseudauricoma* with which it was collected.

Distribution Western Pacific. 38–406 m (IOT records 169–176 m).

Ecology and life history Epizoic, often found attached to the spines of sea urchins, the IOT specimens were found attached to a moribund gorgonian skeleton.

***Solidobalanus pseudauricoma* (Broch, 1931)**

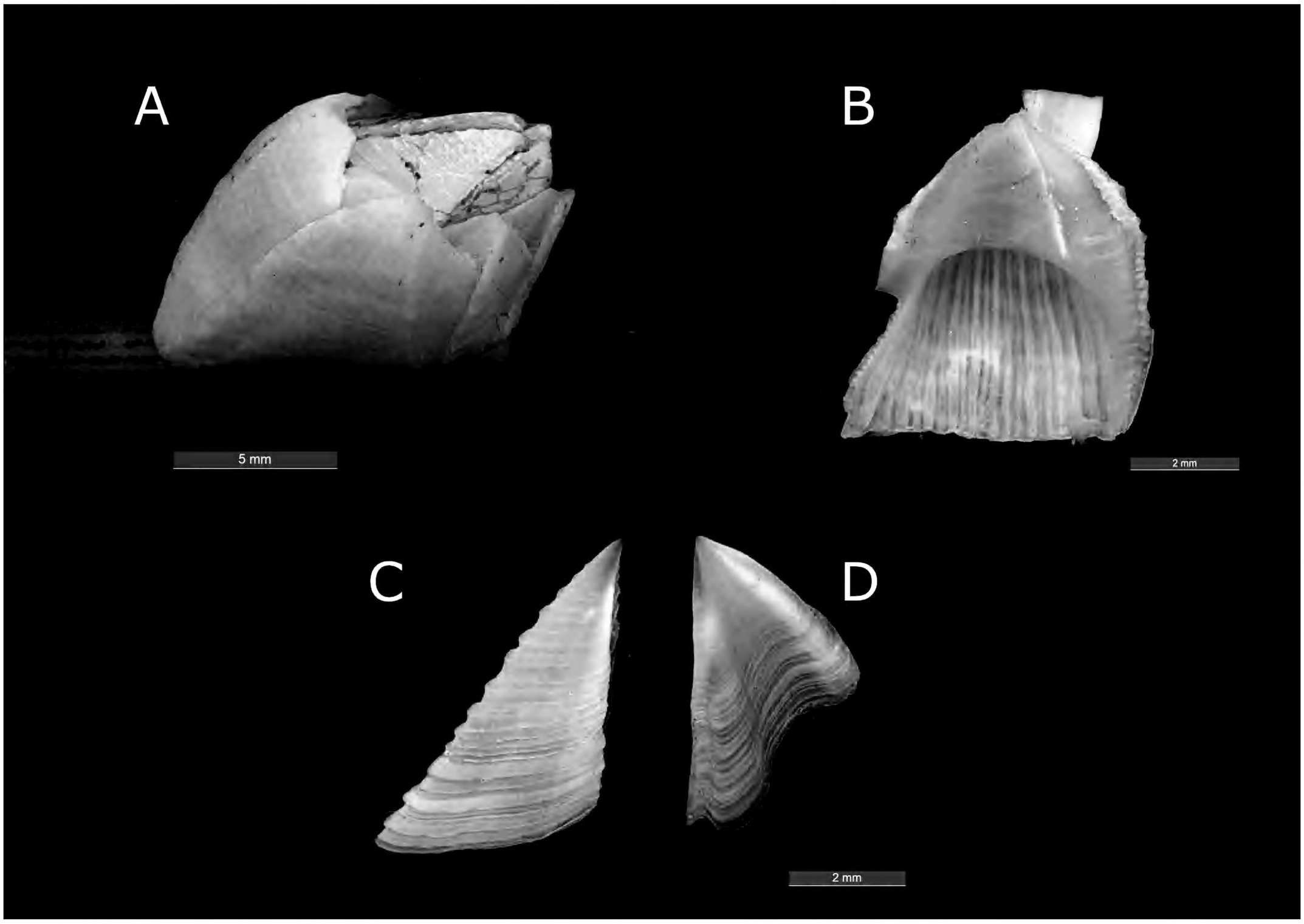

Figure 4. *Solidobalanus pseudauricoma* (A) WAM C78600 (Op 018) specimen attached to echinoid spine, (B-D) WAM C80022 (Op 128), dissected specimen showing (B) internal structure of lateral plate, external view of the (C) scutum and (D) tergum.

Diagnosis Shell wall with six white, solid plates, some tinged pink. Parietes smooth without external longitudinal ribs. Internally plates with numerous longitudinal ridges reaching base. Opercular plates with fine growth lines. Tergum relatively broad with adductor muscle crests confined to near basal-carinal angle, spur short, less than own width from scutal margin. Scutum with prominent articular ridge and groove.

Taxonomic remarks This species has been reported from the western Pacific and into the Indo-Malay Archipelago, but these specimens extend the range into the Indian Ocean. The smooth parietes and broad tergum serves to separate this species from *S. hawaiensis* with which it co-occurs.

Distribution Western Pacific. 80–500 m (IOT records 442–463 m).

Ecology and life history Epizoic, the IOT specimens were found attached to the spines of an echinoid and a moribund gorgonian skeleton.

Order Calanticomorpha

Family Calanticidae

cf. *Scillaelepas*

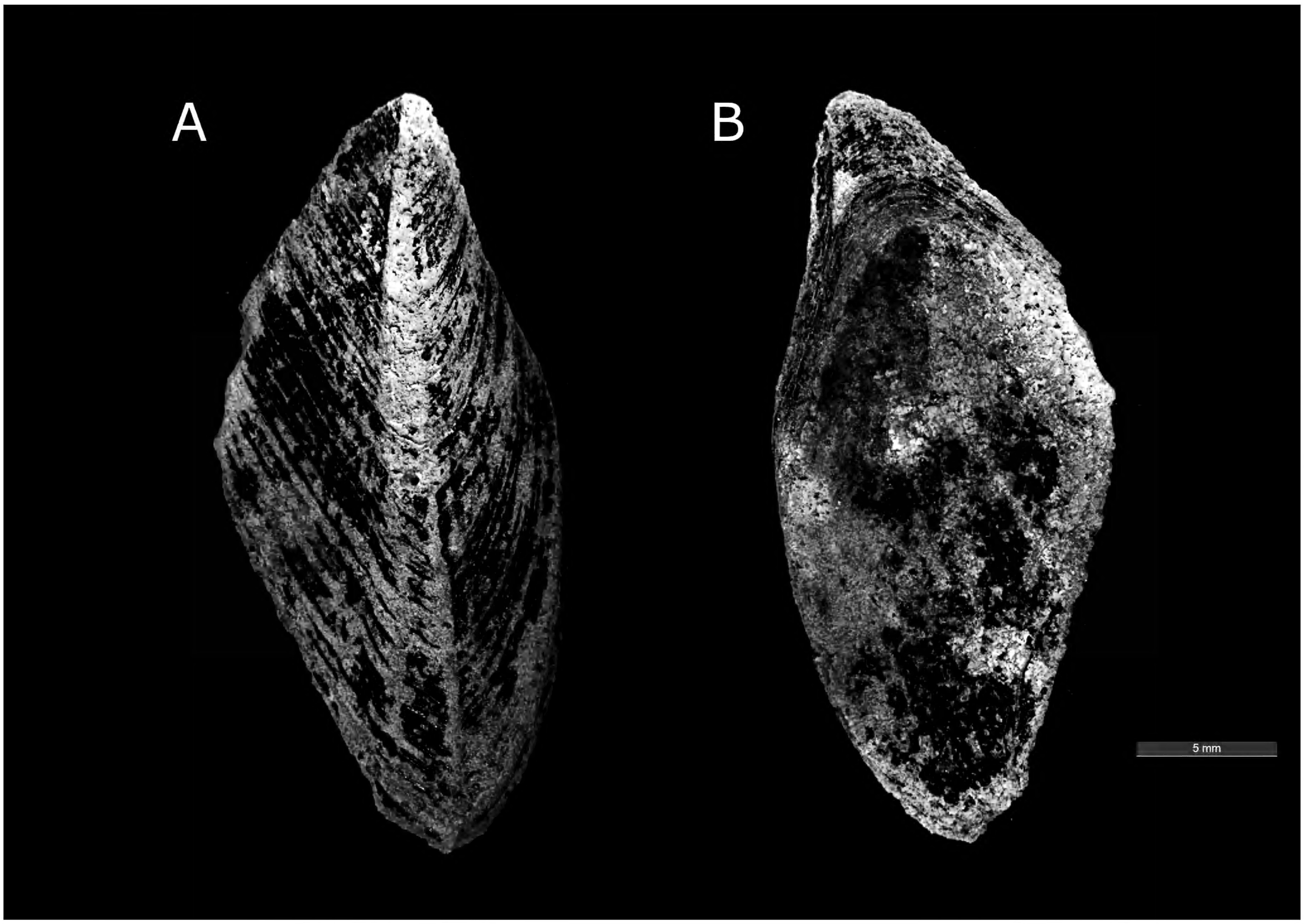

Figure 5. cf. *Scillaelepas*. WAM C82259 (Op 187) (A) external and (B) internal views of subfossil tergum.

Diagnosis Tergum elongate and elliptical with strong apico-basal ridge.

Taxonomic remarks The single disarticulated plate is partially covered by a ferromanganese crust and pitted with erosion suggesting that it is substantially old. While it is not possible to identify with certainty it has been included in this catalogue as the only representative of this group of genera collected during the study. The genus Scillaelepas and related genera are found globally but few are known from this part of the Indian Ocean, and it is possible this specimen represents a locally extinct population or species.

Distribution IOT records 2156–2458 m.

***Smilium acutum* (Hoek, 1883)**

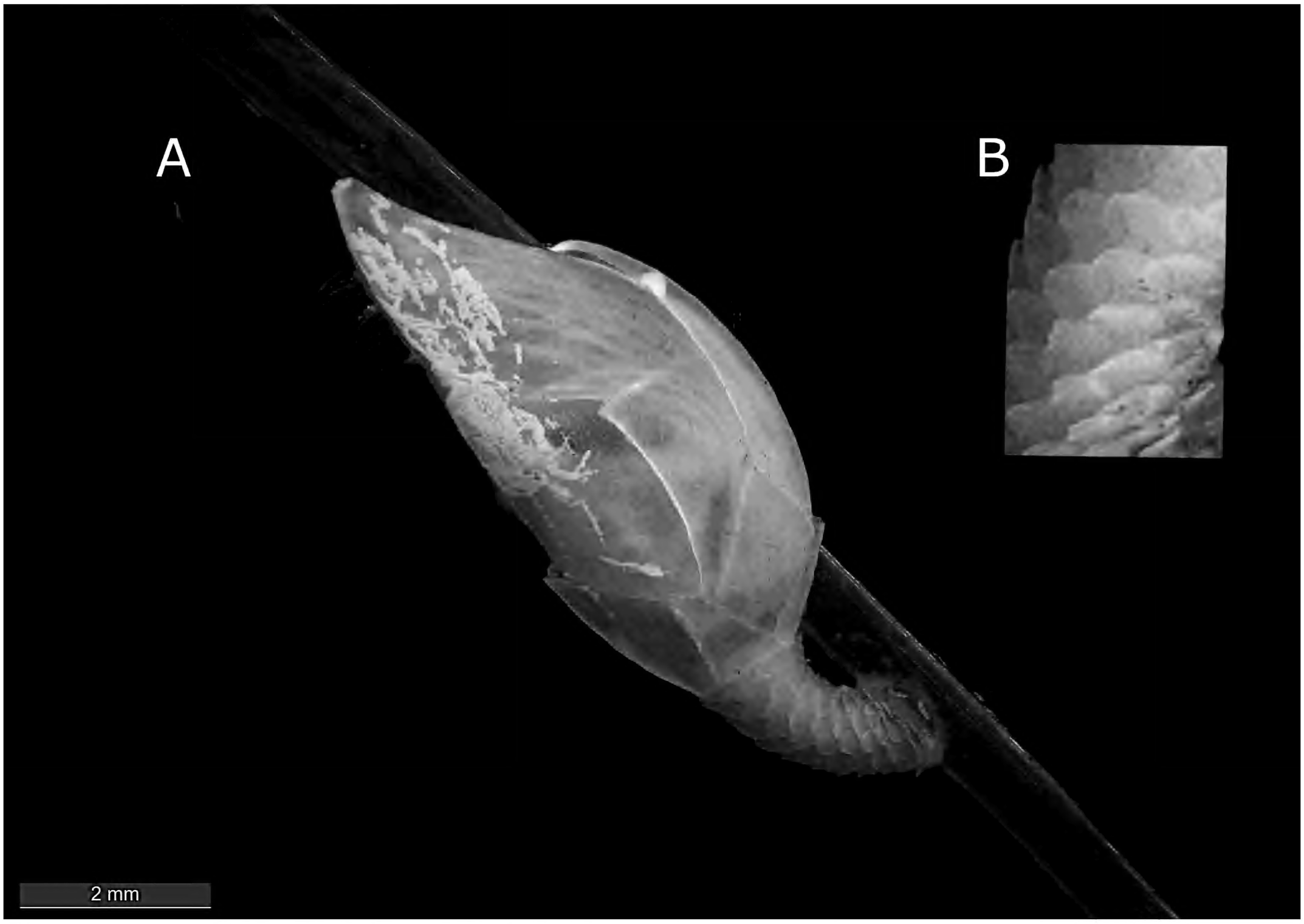

Figure 6. *Smilium acutum*. WAM C78459 (Op 26) (A) attached to hydroid stem and (B) close up detail of peduncular scales.

Diagnosis Capitulum elongate with 13 smooth capitular plates, with subcarina, lacking rostrolatus, without membranous spaces between plates. Inframedian latus triangular, smaller than rostrum; carinolatus diamond shaped. Carina simply bowed with apical umbo. Stalk with overlapping sub-circular scales.

Taxonomic remarks The elongate capitulum and snake-like scales on the stalk serve to separate this species from the other members of the genus.

Distribution Atlantic, Indian and Pacific Oceans. 61–2480 m (IOT records 1915–1990 m).

Ecology and life history Although *S. acutum* are hermaphrodites, this species also contains dwarf, complemental males that have a much-reduced morphology, such as only six plates. These males attach to the inside edge of the scutum.

Order Scalpellomorpha

Family Heteralepadidae

Heteralepas cf. *newmani* Buhl-Mortensen and Mifsud, 2017

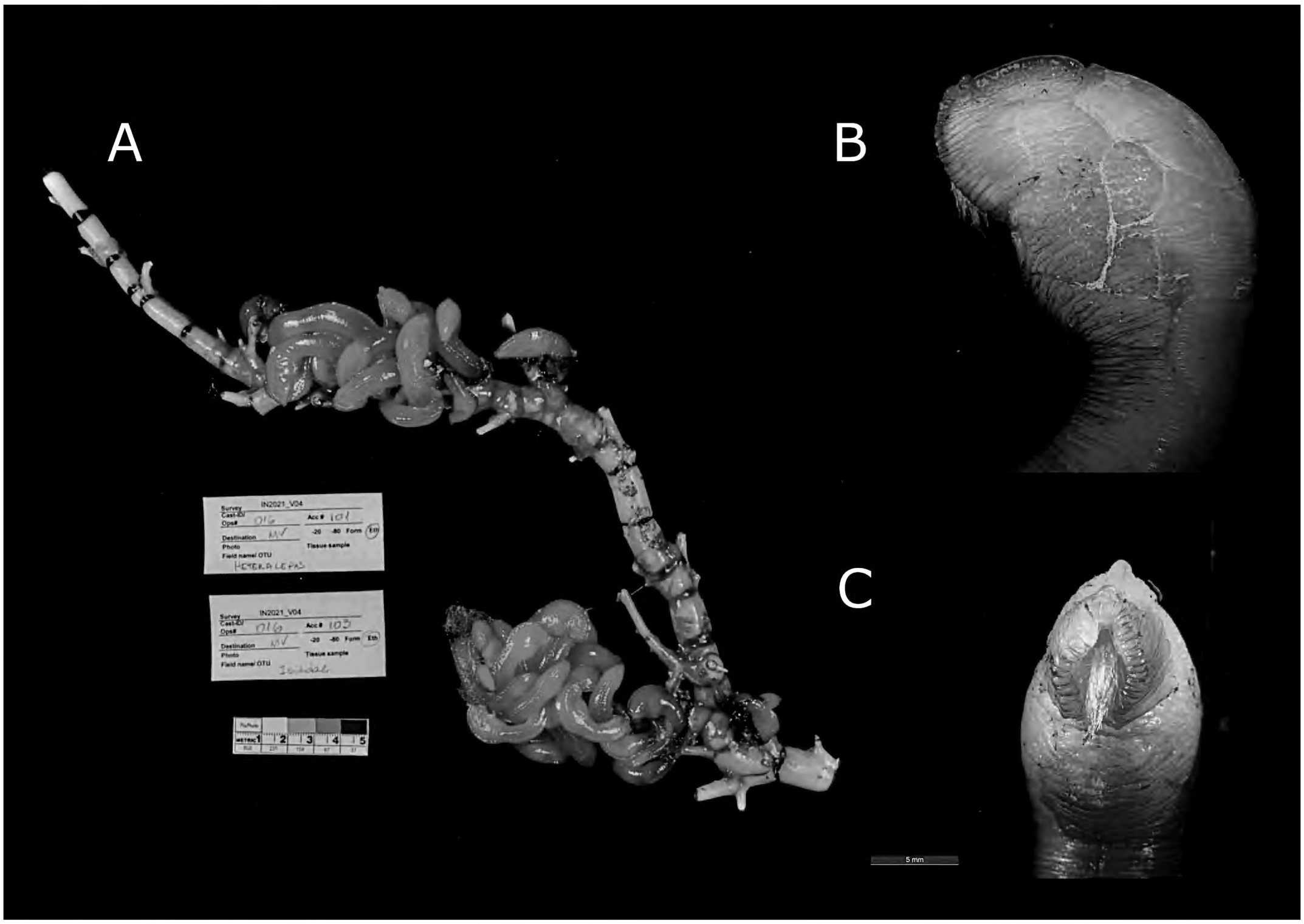

Figure 7. *Heteralepas* cf. *newmani*. WAM C78437 (Op 16) (A) cluster of specimens attached to dead bamboo coral skeleton, (B) lateral and (C) rostral view of capitulum showing absence of plates and presence of dorsal crest.

Diagnosis Capitulum without calcified plates, scutum represented only by a chitinous patch under the orifice. Integument thick, forms a rounded crest running along dorsal margin from the stalk over the capitulum to orifice. Stalk longer than capitulum, at least in larger specimens. Cirri V and VI with greatly reduced posterior ramus compared to anterior ramus. Colour in life bright orange red.

Taxonomic remarks *Heteralepas newmani* was relatively recently described from the Mediterranean and based on COI sequences (unpub. data) the present specimens from the IOT are genetically indistinguishable. In turn, COI data shows that another species, *H. gettyburgensis* from the Gettysburg Seamount (west of Portugal), is also conspecific and should be synonymised under *H. newmani*, which has priority, albeit by only three months. The genetic identification appears to be at odds with a morphological comparison between these species and the IOT specimens. The Atlantic and Mediterranean species are much smaller and lack the dorsal crest seen in the current specimens. The IOT specimens would also appear to greatly extend the geographic and bathymetric range. Further study is required to determine the range of variability, both morphological and genetic, of this species. However, based on the present molecular data then species in this genus can be morphologically, highly variable and further synonymy with Indo-Pacific species is likely.

Distribution Atlantic Ocean, including Mediterranean. 100–250 m (IOT records 328–1114 m).

Ecology and life history The IOT specimens were attached to a large piece of Bamboo coral. The type specimens were collected attached to rope in the Mediterranean Sea. Another sample of possible juveniles were attached to a piece of black coral (Op 138).

***Paralepas* sp. 1**

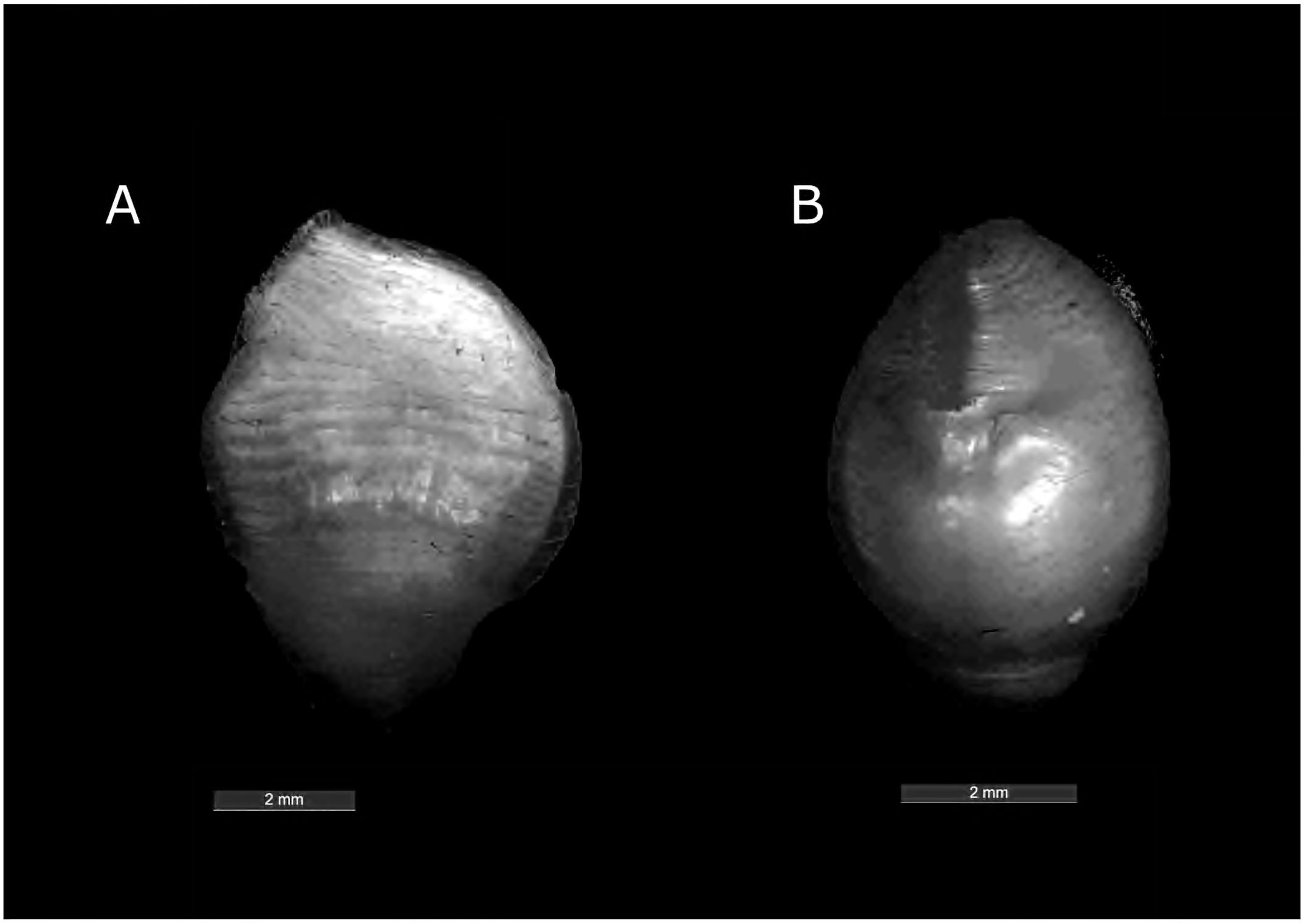

Figure 8. *Paralepas* sp. 1. WAM C78409 (Op 005)(A) lateral and (B) rostral view.

Diagnosis Capitulum globular without calcified plates, only chitinous, triangular scuta present below orifice, lacking obvious dorsal crest. Stalk shorter than capitulum. Integument thick, somewhat wrinkled lacking ornamentation, underlying tissue pearlescent. Cirri II –VI with subequal rami, segments square with setation of acanthopod type.

Taxonomic remarks The genus *Paralepas* is difficult to work with owing to the small size of the species and external characters that are susceptible to distortion through preservation and life stage. The current specimens seem most similar to *P. minuta* a species with a reportedly cosmopolitan distribution.

Distribution IOT records 643–997 m.

Ecology and life history These specimens were attached to the spines of an echinoid.

Family Lepadidae

Lepas pectinata Spengler, 1793

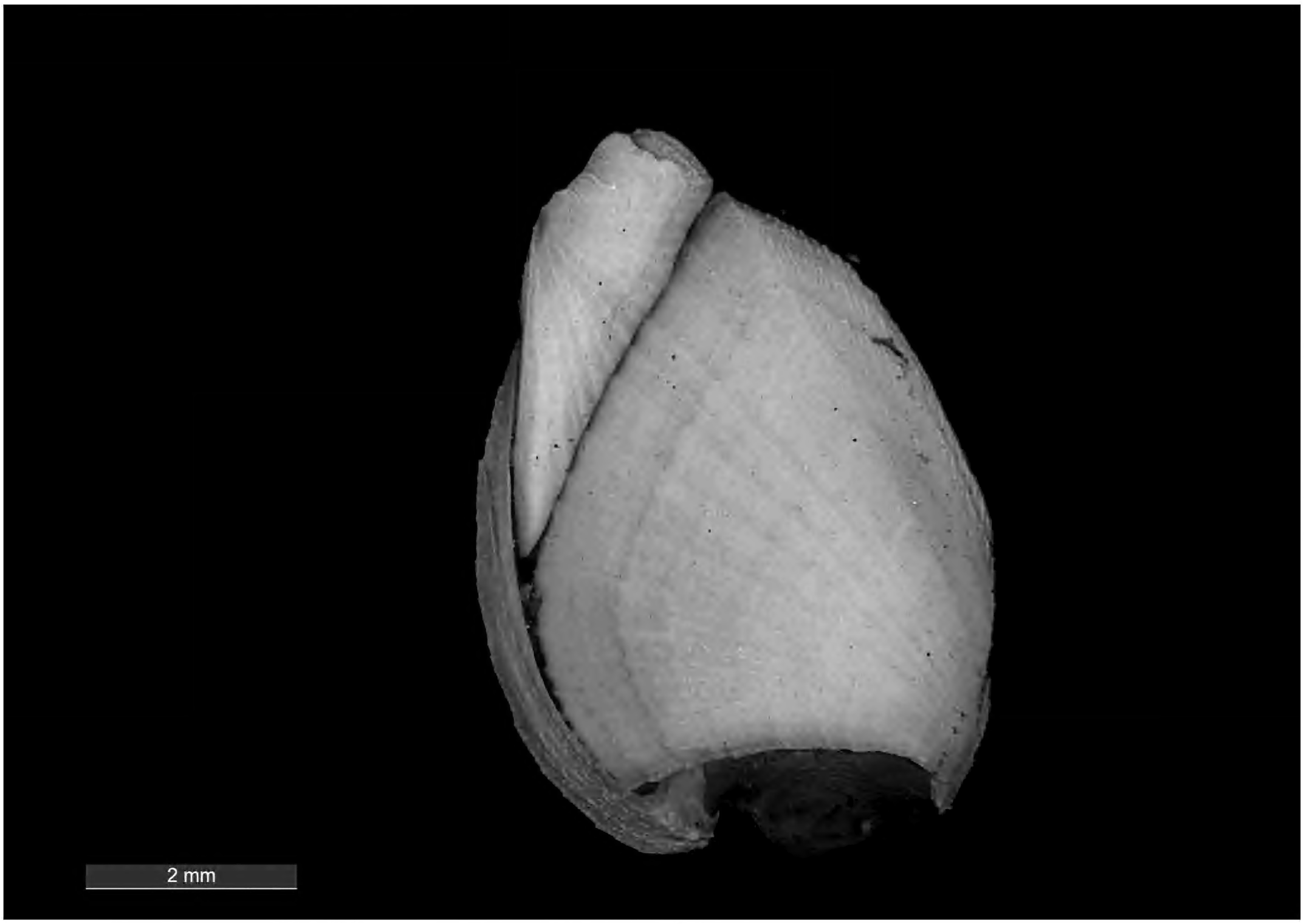

Figure 9. *Lepas pectinata*. WAM C82262 (Op 141) the empty but still intact capitulum suggests the specimen died recently.

Diagnosis Capitulum with five plates bearing conspicuous radial ridges, sometimes spinose. Carina extending to midway along tergum, basally carina is anchored into the integument with two diverging prongs. Stalk much shorter than capitulum.

Taxonomic remarks The specimens collected during this expedition were empty shells and had either sunk to the seafloor or were collected from surface waters as the beam trawl was being retrieved or deployed. A phylogeographic study including *L. pectinata* collected from the Atlantic and Pacific Oceans did not detect any significant genetic divergence. This indicates that *L. pectinata* may be a truly global species, excepting polar seas.

Distribution Atlantic, Indian and Pacific Oceans. Pelagic (IOT records 1110–1764 m).

Ecology and life history This species attaches to floating objects such as velvet snails (*Janthina* spp.), rams horn squid shells (*Spirula* spp.) and artificial substrates, but never to benthic substrates such as rocks.

Family Poecilasmatidae

***Glyptelasma gracile* (Hoek, 1883)**

Figure 10. *Glyptelasma gracile*. WAM C77904 (Op 018) lateral view.

Diagnosis Capitulum with 5 smooth plates. Scutum with basal umbo, occludent margin gently curved in upper quarter. Carina does not extend beyond base of tergum, with laterally expanded basal region that extends below scutum so that basal margin of capitulum has a right-angled bend. Prosoma bearing two short, dorsal filamentary appendages.
Taxonomic remarks *Glyptelasma gracile* can be distinguished from *G. pilsbryi*, which also has the right-angled bend on the basal margin, by the narrower tergum with a simple apex. In *G. pilsbryi*, the apex of the tergum is recurved towards the carinal margin.
Distribution Eastern Indian and western Pacific Oceans. 395–935 m (IOT records 442–463 m).
Ecology and life history Often epizoic, attaching to a variety of corals and sponges, living or dead.

Glyptelasma orientale (Calman, 1919)

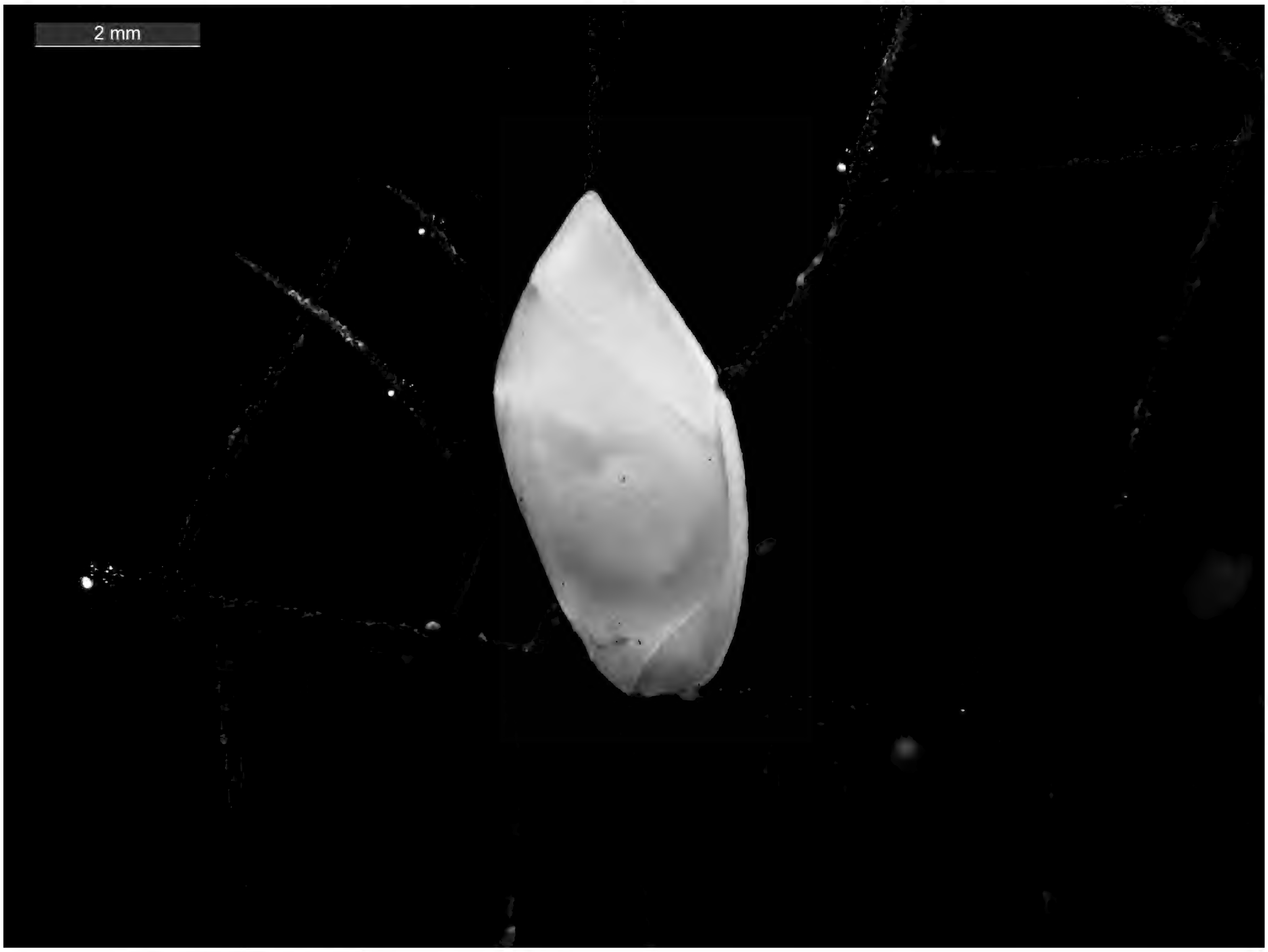

Figure 11. *Glyptelasma orientale*. WAM C78422 (Op 009) lateral view attached to a black coral skeleton.

Diagnosis Capitulum with 5 smooth plates. Scutum with basal umbo, occludent margin curved in upper quarter. Carina does not extend beyond base of tergum, carina with laterally expanded basal region that inserts in smoothly curved notch near the basal angle of scutum so that basal margin of capitulum is straight. Prosoma bearing two short filamentary appendages.
Taxonomic remarks The external appearance of the capitulum resembles several other species of the genus such as *G. hamatum* and *G. carinatum*. However, G. orientale can be separated by details of the filamentary appendage present on cirrus I (absent in the other two species) and the two long appendages on the prosoma (two short, hooked appendages on G. hamatum and numerous long appendages on *G. carinatum*).
Distribution Eastern Indian and West Pacific Oceans. 395–935 m (IOT records 957–1533 m).
Ecology and life history While typically found attached to biotic substrates such as corals, this species was originally described from specimens attached to the Java-Australia telegraph cable.

Glyptelasma cf. *rectum* (Pilsbry, 1907)

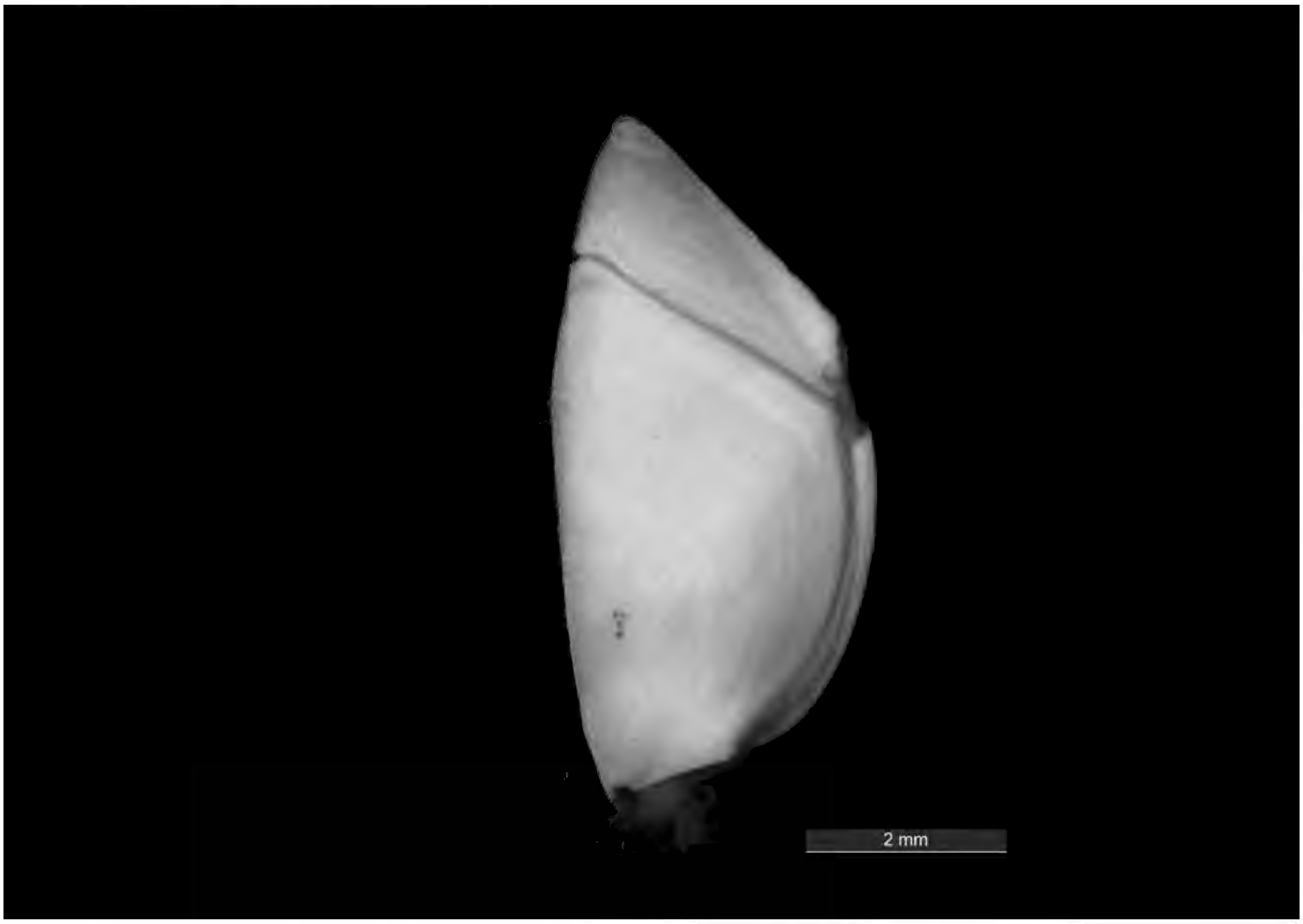

Figure 12. *Glyptelasma* cf. *rectum*. WAM C82264 (Op 155) lateral view.

Diagnosis Capitulum with 5 smooth plates. Scutum with basal umbo. Carina does not extend beyond base of tergum, basal region laterally expanded and inserts in short notch of basal angle of scutum. Capitulum basal margin forms collared ring around stalk. Occludent margin of scutum approximately straight, basal angle 90°. Prosoma bearing two short filamentary appendages.

Taxonomic remarks This species is similar in profile to *G. alatum* however that species is described has having a carina that broadens over its length and that the basal part has wing-like projections as opposed to the two simple, short prongs seen in these specimens. *Glyptelasma* cf. *rectum* was first reported in the Indian Ocean from Cape Range Canyon, near the coast of Western Australia (Wilson *et al.*, 2022) but *G. rectum* is known only from the northern Atlantic Ocean. This disjunct distribution raises doubts over the conspecificity of the two populations.

Distribution Atlantic and Indian Oceans. 1459–3947 m (IOT records 1459–1595).

Ecology and life history These specimens represent the shallowest records for the species and were attached to the long rod-like spicules of a glass sponge.

Megalasma minus Annandale, 1906

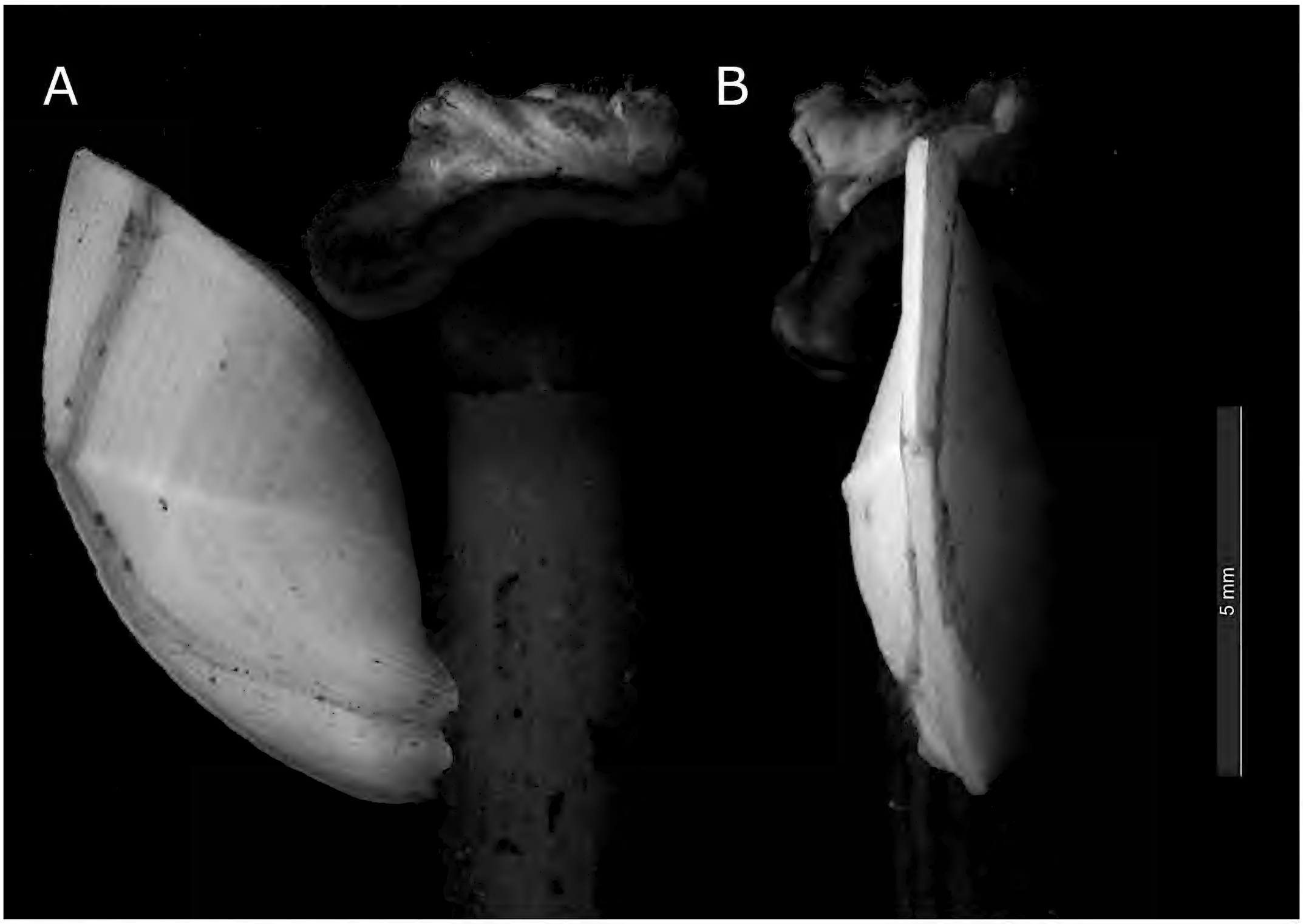

Figure 13. *Megalasma minus*. WAM C78441 (Op 018) attached to echinoid spine. (A) lateral and (B) carinal view.

Diagnosis Capitulum with five radially striate plates, striations very fine and numerous. Scutum with umbo positioned above basal angle, distinct ridge running from basal angle to carina-tergum junction. Carina broadened in lower half, not extending beyond base of tergum. Basal margin of capitulum forming collar over short stalk.

Taxonomic remarks The apparent cosmopolitan distribution of this species has not been tested with molecular analyses and *M. minus* would make an excellent candidate for testing deep water biogeographic boundaries. This species can be distinguished from *M. striatum* and *M. elegans* by the much more delicate sculpture of the plates and the relatively smaller tergum and carina relative to the scutum.

Distribution Atlantic, Indian and Pacific Oceans. 295–2050 m (IOT records 328–1114 m).

Ecology and life history This species is typically epibiotic and commonly found attached to the spines of sea urchins. Despite not being recorded from abiotic substrates like rocks, this species has been known to attach to telecommunications cables (Calman, 1919).

Minyaspis aurivillii (Stebbing, 1900)

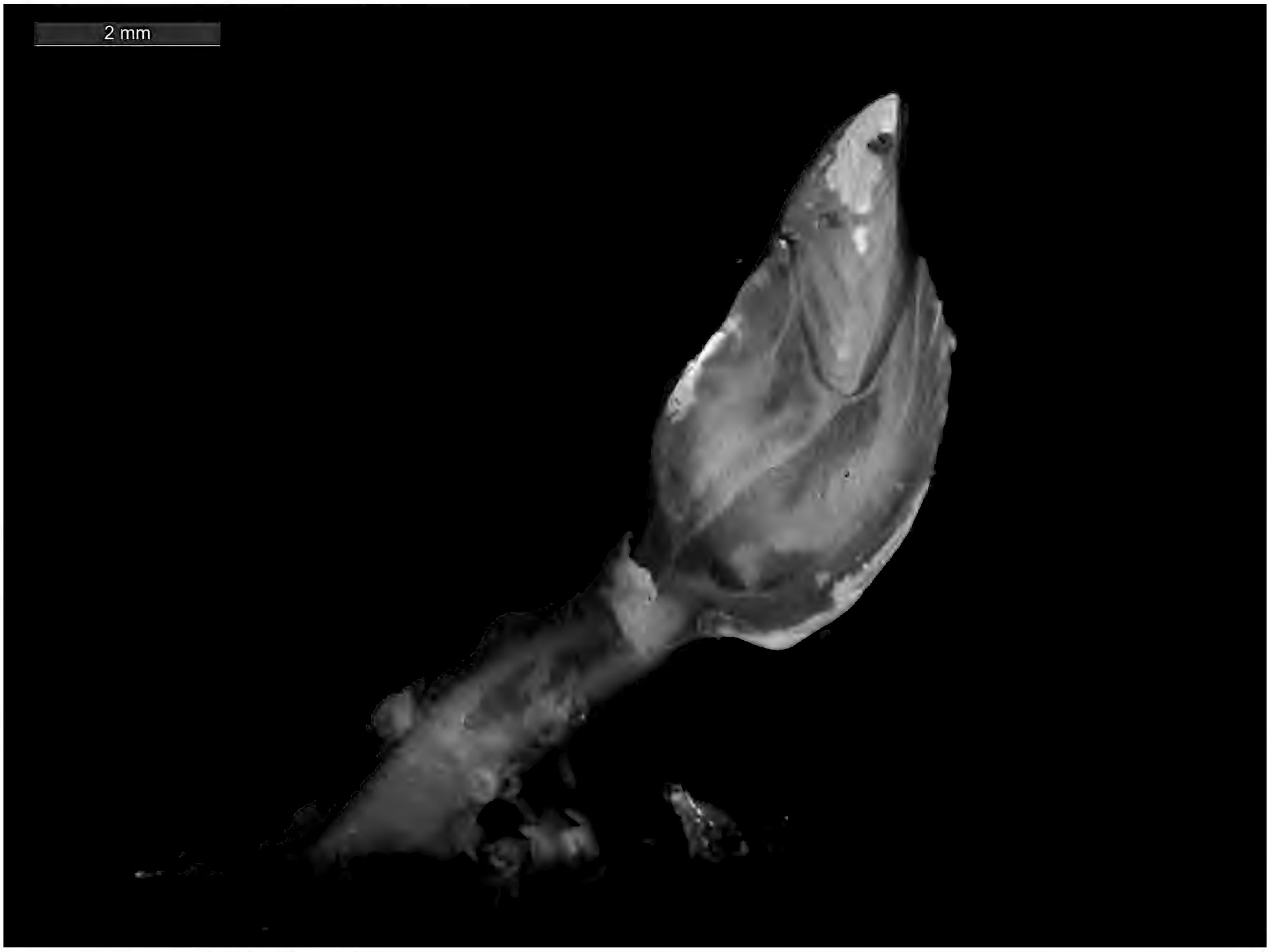

Figure 14. *Minyaspis aurivillii*. WAM C82263 (Op 128) attached to black coral branch. Host polyps can be seen growing on the barnacle's stalk.

Diagnosis Capitulum with five smooth, thin plates. Scutum reduced in size leaving a large membranous interspace between it, the tergum and carina, umbo medial on occludent margin. Carina extending midway up the length of tergum, with almost right-angle bend at sub-basal umbo. Capitulum with reddish-brown longitudinal stripes.

Taxonomic remarks Other members of this genus with a reduced scutum have the basal margin notched or obviously concave (e.g. *M. faroni*, *M. opreskoi*, and *M. bocki*) or have a serrated occludent margin on the tergum (e.g. *M. welchi*).

Distribution Indian and western Pacific Oceans. 10–453 m (IOT records 328–404 m).

Ecology and life history This species is an obligate symbiont attaching to the branches of black corals. The black coral will eventually grow over the barnacle so that capitulum is often completely hidden by coral polyps.

Poecilasma kaempferi Darwin, 1852

Figure 15. *Poecilasma kaempferi*. WAM C78506 (Op 035) lateral view.

Diagnosis Capitulum with five smooth plates. Scutum with basal umbo. Carina not extending beyond the base of the tergum, and basally not laterally broadened, umbo basal and tucked below scutum. Prosoma without filamentary appendages. Capitulum white cream in colour, stalk light brown.

Taxonomic remarks This species has several subspecies and synonyms that are of uncertain validity making identification and the interpretation of distributional records difficult. The global distribution and large depth range suggest that there are multiple species present.

Distribution Atlantic, Indian and Pacific Oceans. 19–1885 m (IOT records 1260–2435 m).

Ecology and life history Members of this genus are epibiotic and are typically associated with decapod crustaceans. Perhaps the wide geographic and bathymetric distribution of these barnacles can be explained by the often highly mobile host species.

***Rhizolepas* sp. 1**

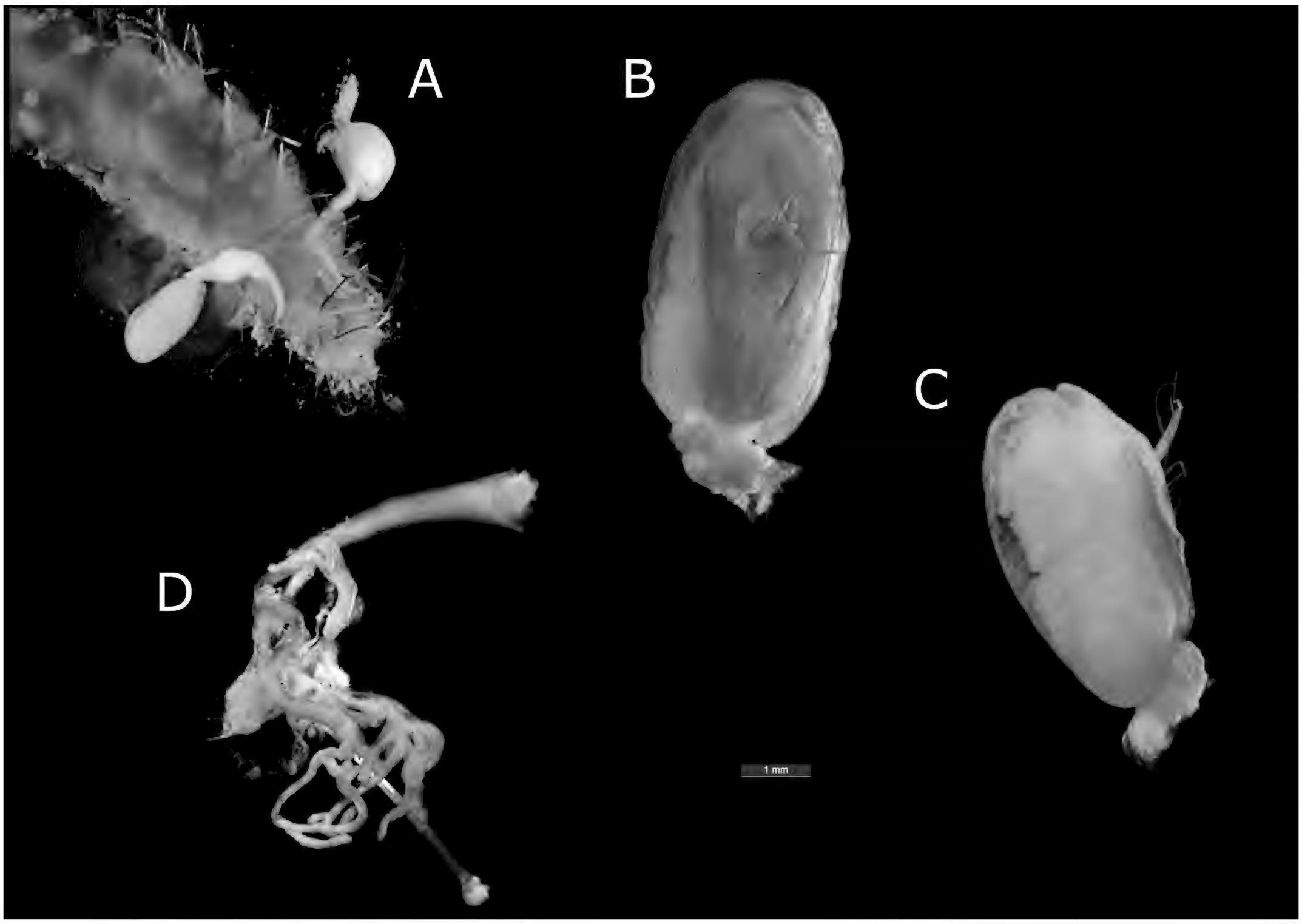

Figure 16. *Rhizolepas* sp. 1. (A) WAM C78472 (Op 028) two specimens still attached to anterior segments of host polychaete, (B–D) WAM C77917 (Op 028) dissected specimen showing capitulum in (B) frontal view, (C) lateral view, and (D) stalk with branching roots.

Diagnosis Capitulum without calcified plates, scutum elongate forming yellow chitinous bars either side of orifice, membranous mantle partially envelops prosoma. Cirri degenerate, not capable of filter feeding. Mouthparts absent. Stalk embedded into host forming branching root-like structure.

Taxonomic remarks Until recently this aberrant, parasitic genus was placed in its own family, the Rhizolepadidae, on account of the bizarre reduction of typical barnacle characters, which made assessing phylogenetic affinities a guessing game. There are presently two described species in the genus and recent molecular analysis based on an undescribed species, surprisingly, demonstrated that this genus belongs within the Poecilasmatidae (Watanabe *et al.*, 2023). The loss of limbs and typical barnacle characters makes separating species difficult, but it is expected that the IOT specimens represent a fourth and undescribed species.

Distribution IOT records 2760–2850 m.

Ecology and life history This species is parasitic on scale worms (*Laetmonice* sp.). The mouthparts are absent, and the barnacle derives nutrition from the root-like structure embedded in the body of the host.

Family Scalpellidae

***Amigdoscalpellum elegans* (Hoek, 1907)**

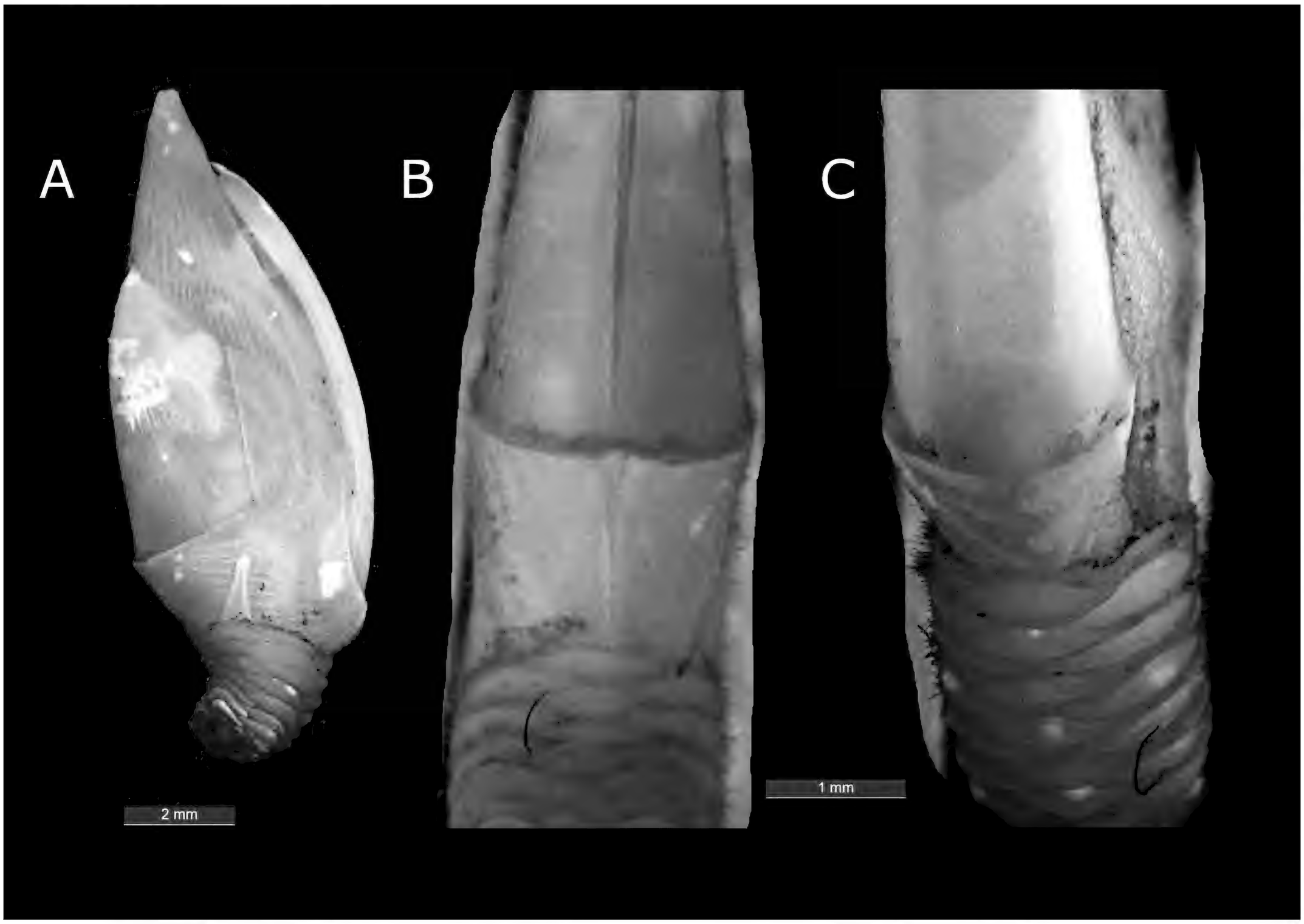

Figure 17. *Amigdoscalpellum elegans*. WAM C78593 (Op 040) (A) lateral view, (B) rostral view showing vestigial rostrum typical of many Scalpellidae, and (C) carinal view showing interdigitating carinal junction.

Diagnosis Capitulum with 14 radially striated plates. Carina evenly bowed, forming a membranous interspace between it and the adjacent tergum and upper latus of larger specimens, carinal roof bounded by longitudinal ridges. Tergal apex narrow, acute. Inframedian latus triangular with apical umbo, shorter than carinolatus and rostrolatus, not reaching upper latus.

Taxonomic remarks Young (2007) discussed some of the characters in use to distinguish species of this genus and concluded that several are likely to be due to changes during ontogeny and thus some described species are only life stages of each other. In *A. elegans* one of the key characters identifying this species that may be the result of ontogeny is the small membranous gap between the carina and the tergum and upper latus. In the present specimens a range of sizes all show this gap and have a generally narrow appearance compared with *A. vitreum*. Recent molecular phylogenies have shown divergent lineages that present very similar morphologies to *A. elegans* (Lin *et al.*, 2015).

Distribution Indian and western Pacific Oceans. 600–1886 m (IOT records 1237–3611 m).

Ecology and life history The current specimens extend the known bathymetric range from 1886 m to 3611 m.

Amigdoscalpellum cf. *manum* (Zevina, 1973)

Figure 18. *Amigdoscalpellum* cf. *manum*. WAM C82269 (Op 181) lateral view.

Diagnosis Capitulum with 14 smooth, thin plates leaving no membranous interspaces between them. Carina evenly bowed, roof flat bounded by lateral ridges, upper latus with subapical umbo displaced by secondary apical extension. Inframedian latus triangular, very narrow, umbo apical, not reaching upper latus. Carinolatus umbo sub-basal.

Taxonomic remarks These specimens match *A. manum* using the keys published by Zevina (1981) but differ in that the umbo of the carinolatus is almost medial in her figures, rather than sub-basal as seen in the present sample.

Distribution East Indian Ocean. 2081–2533 m (IOT records 2889–2923 m).

Ecology and life history This species is very poorly known, and it has only been tentatively identified from Cape Range Canyon near Western Australia (Wilson *et al.*, 2022) since it was described in 1973.

Amigdoscalpellum vitreum (Hoek, 1883)

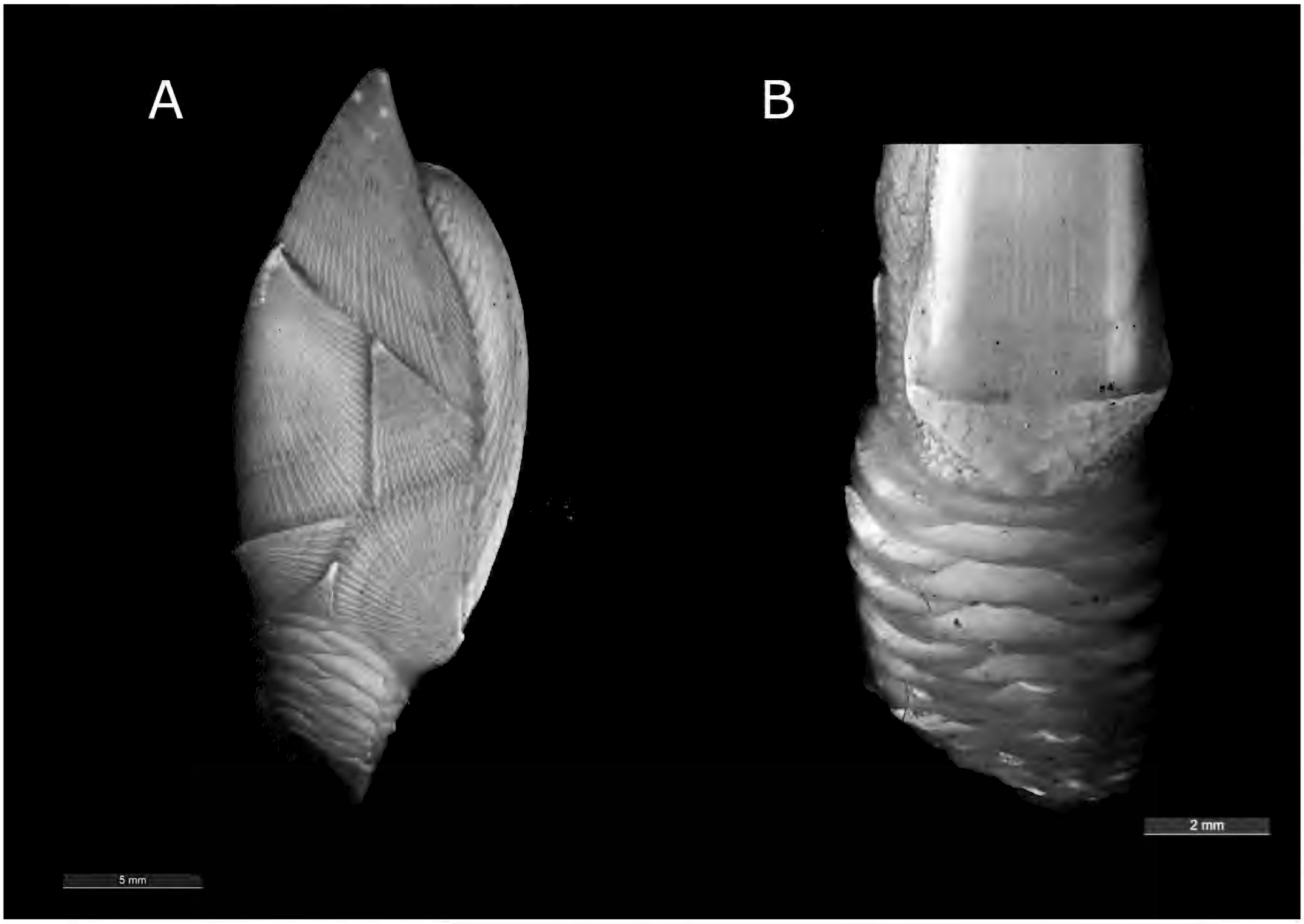

Figure 19. *Amigdoscalpellum vitreum*. WAM C80020 (Op 115) (A) lateral view, (B) close up carinolatera at base of carina showing interdigitating carinolateral junction and peduncular scales.

Diagnosis Capitulum with 14 radially striated plates. Carina evenly bowed, without a membranous interspace between it and the adjacent tergum and upper latus, carinal roof bounded by longitudinal ridges. Inframedian latus triangular with apical umbo, shorter than carinolatus and rostrolatus, not reaching upper latus.

Taxonomic remarks Young (2007) discussed some of the characters in use to distinguish species of this genus and concluded that several are likely to be due to changes during ontogeny and thus some described species are only life stages of each other.

Distribution Indian and western Pacific Oceans. 550–6096 m (IOT records 1237–3100 m).

Ecology and life history Specimens were often collected attached to pumice stone which were common among the survey sites.

Anguloscalpellum **sp. 1**

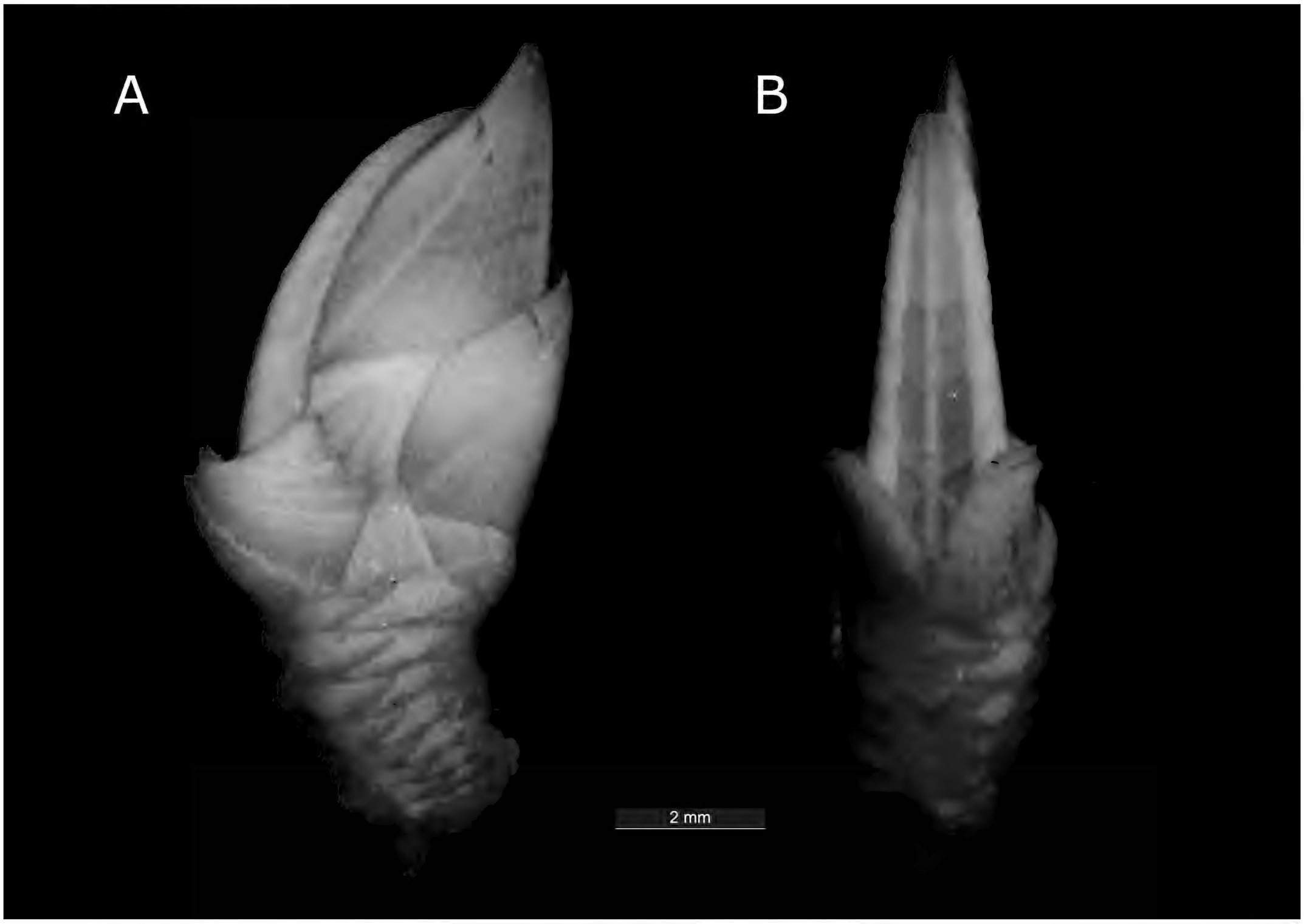

Figure 20. *Anguloscalpellum* sp. 1. WAM C82272 (Op 128) (A) lateral view, (B) carinal view showing simple carinolateral junction and divergent apices.

Diagnosis Capitulum with 14 radially striated ridges without membranous gaps in between. Carina evenly arched, roof bounded by lateral ridges set off from medial ridge by deep grooves. Upper latus subtriangular, inframedian latus triangular with apical umbo, basal margin as broad as rostrolatus. Carinolatus twice height of rostrolatus, umbo produced and extending beyond carina. Peduncular scales imbricating, protruding prominently from stalk integument.
Taxonomic remarks These specimens do not closely match most members of this genus which appear to have low, strap-like rostrolatera. This species has an almost square rostrolatus, similar to *A. angulare* (Nilsson-Cantell, 1930) from the South Shetland Islands but this latter species lacks the medial ridge of the carina as well as differences in the relative size and shape of the plates.
Distribution IOT records 328–404 m.
Ecology and life history These specimens were collected attached to a rock.

Arcoscalpellum cf. *angularum* Gan, Xu, Li & Wang, 2020

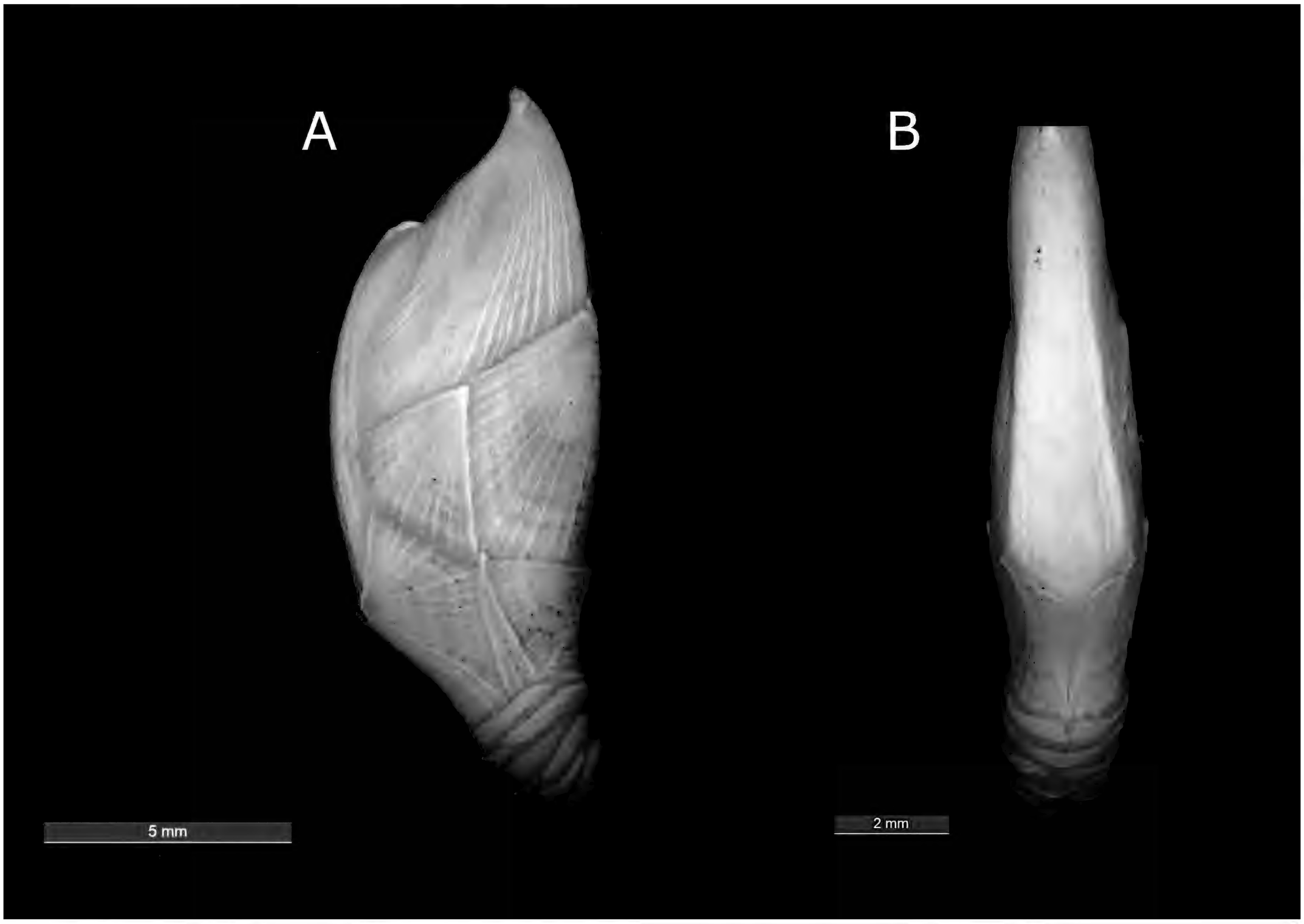

Figure 21. *Arcoscalpellum* cf. *angularum*. WAM C80010 (Op 122) (A) lateral view and (B) carinal view showing simple carinolateral junction.

Diagnosis Capitulum with 14 radially striated plates without membranous interspaces in between. Tergum apex recurved towards carina. Carina evenly bowed, roof flat bounded by low, lateral ridges. Carinolatus umbo just above mid-point on carinal margin, not upturned, carinolateral junction simple, not interdigitating. Inframedian latus narrowly triangular, umbo apical, reaching upper latus, slightly curved towards scutum. Stalk with very broad scales, reduced in number to a carinolatus/subcarinal-rostrolatus arrangement.

Taxonomic remarks *Arcoscalpellum angularum* was recently described from Weijia Guyot in the western Pacific. The present specimens exhibit some small differences in the capitular plates that warrant further investigation, such as the curved apex of the tergum and the detail of the carinolatus junction. Should these differences prove to be intraspecific variation then the present record extends the range to the Indian Ocean and the depth by an additional 3000 m.

Distribution Western Pacific Ocean. 1935 m (IOT records 4980–4990 m).

Ecology and life history The IOT records are the first for the Indian Ocean. Epizoic, the single specimen was attached to a black coral.

Arcoscalpellum michelottianum **(Seguenza, 1876)**

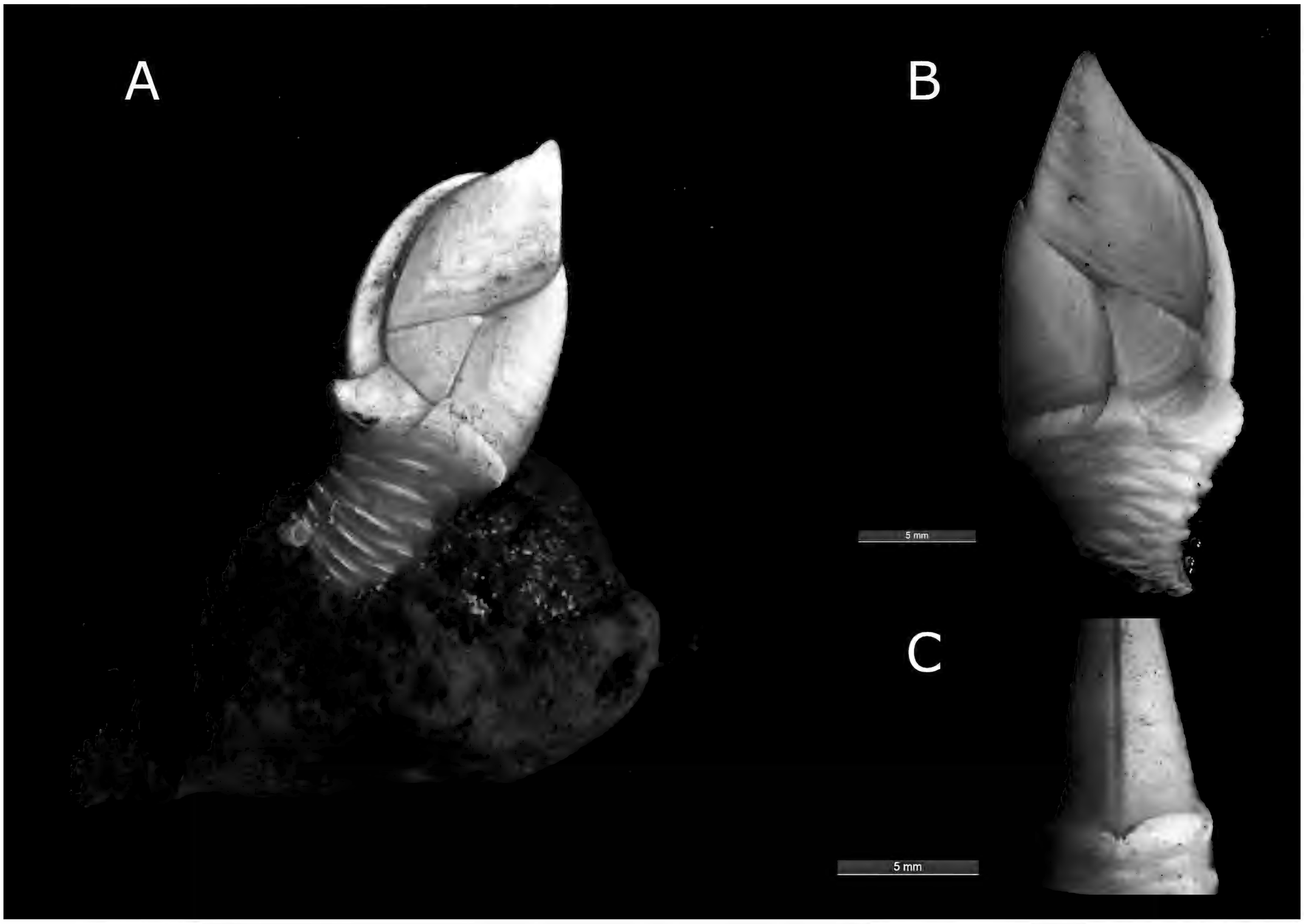

Figure 22. *Arcoscalpellum michelottianum*. (A) WAM C82276 (Op 113) CL 31 mm female specimen attached to rock, (B, C) WAM C78512 (Op 037) CL 16 mm female specimen in lateral and rostral view, respectively.

Diagnosis Capitulum with 14 plates without radial striations or membranous interspaces in between, epidermis with or without short setae. Carina evenly bowed, roof smooth, bounded by lateral ridges. Carinolatus umbo subapical on carinal margin, upturned and curved, carinolateral junction not interdigitating. Inframedian latus equilateral triangle, umbo apical, reaching upper latus. Rostrolatus low and broad.

Taxonomic remarks This species has been widely reported and several species are listed as synonyms. Figures of type specimens for *A. michelottianum* and the synonymised *S. eximium* in Shalaeva & Boxshall (2014) suggest that more than one species has been conflated under the name *A. michelottianum* and a global review of specimens is warranted.

Distribution Atlantic, Indian, Pacific Oceans. 64–5190 m (IOT records 643–2923 m).

Ecology and life history Like most Scalpellidae this species is dioecious with the large 'normal' individuals being female. The dwarf males do not resemble the females at all and are small and sack-like, lacking calcareous plates and are unable to feed. They attach to the inside of the female's scutum, and a single female may host up to 40 males (Dreyer *et al.*, 2018).

Arcoscalpellum sculptum (Hoek, 1907)

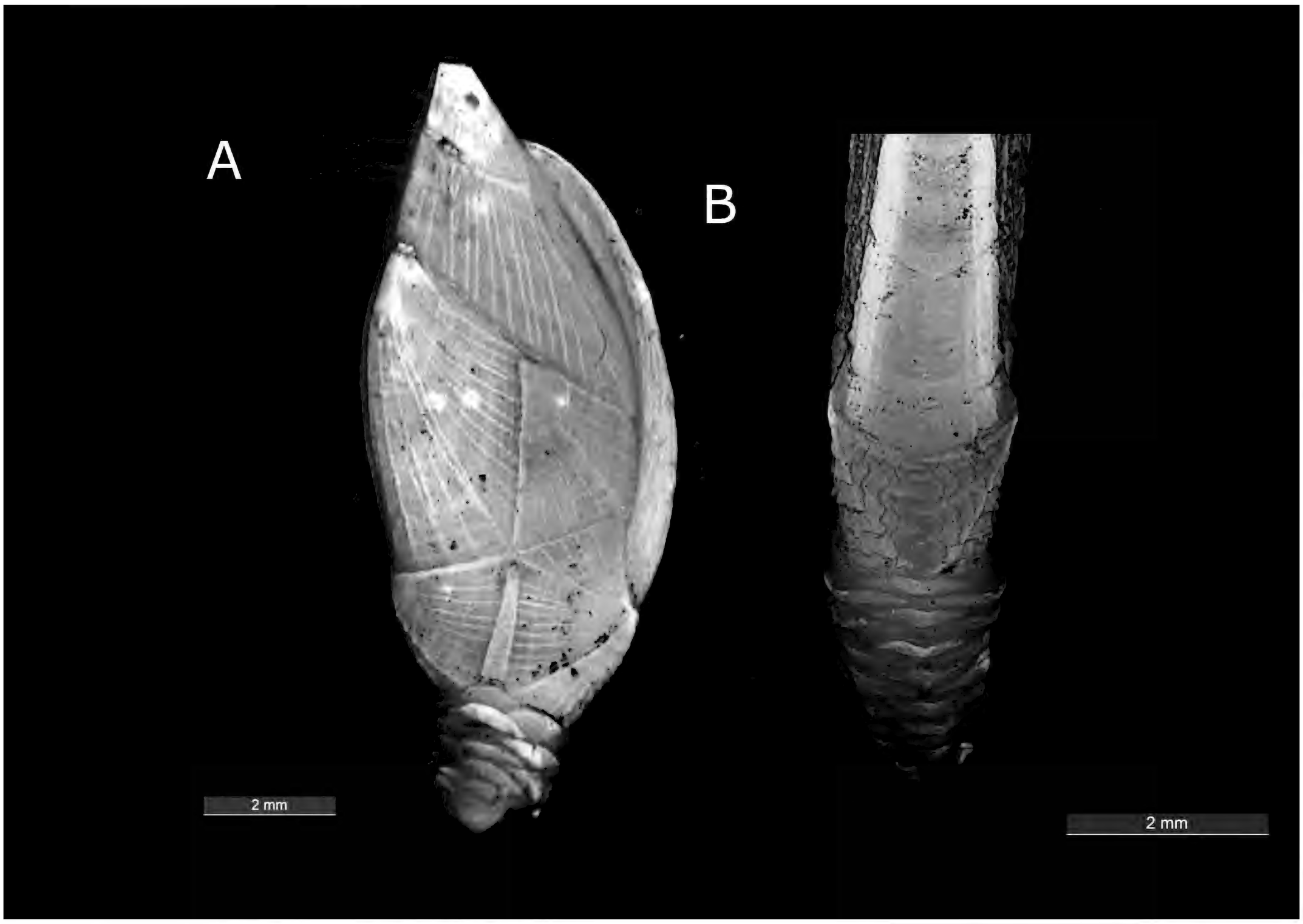

Figure 23. *Arcoscalpellum sculptum*. WAM C80030 (Op 145) (A) lateral view and (B) carinal view showing interdigitating carinolateral junction.

Diagnosis Capitulum with 14 radially striated plates, without membranous interspaces. Carina roof flat, bounded by lateral ridges, apex extending beyond mid-point of tergum. Tergum with apical umbo recurved. Upper latus umbo apical, lacking secondary apical extension. Inframedian latus narrow, almost parallel sided, umbo apical, upper part slightly curved toward scutum. Carinolatus higher than rostrolatus.
Taxonomic remarks This species is very similar to *A. gryllum* with the absence of setae on the capitulum in *A. sculptum* being the only character that readily separates them. Since its description, *A. sculptum* has only been reported on once and was collected from the western Indian Ocean and the Kermadec Trench in the southwestern Pacific Ocean (Young, 2007). According to this account, peduncular scales are larger and fewer than those of the original description or the IOT but otherwise the material compares well.
Distribution Indian and western Pacific Oceans. 2470–5900 m (IOT records 3002–3839 m).

Arcoscalpellum truncatum **(Hoek, 1883)**

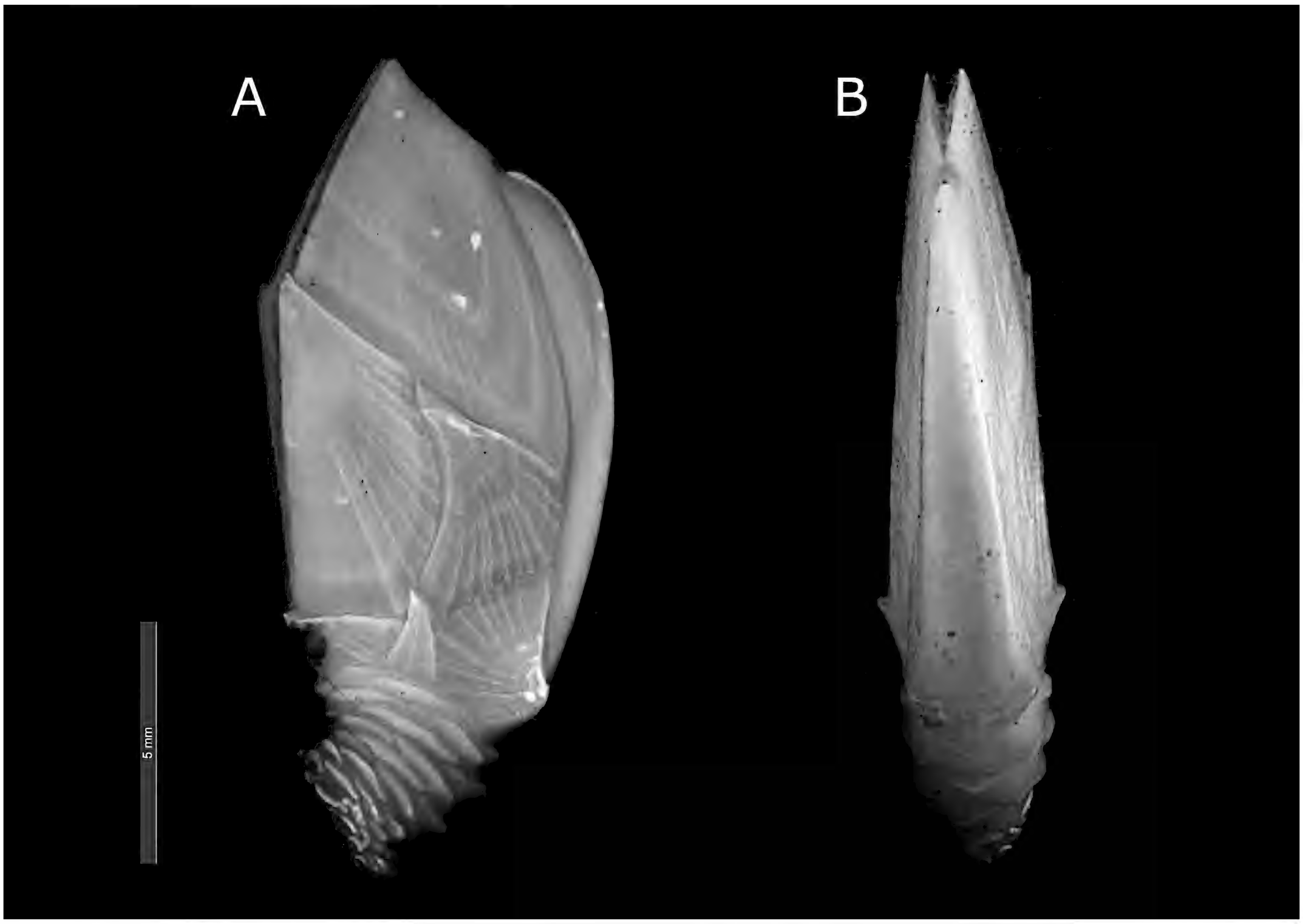

Figure 24. *Arcoscalpellum truncatum*. WAM C80032 (Op 145) (A) lateral and (B) carinal view.

Diagnosis Capitulum with 14 radially striated plates, without membranous interspaces. Tergum broad, apex and occludent-scutal angle forming almost 90° angles. Carina roof flat, bounded by lateral ridges, apex extending beyond distal third of tergum. Upper latus umbo subapical, displaced by short secondary extension. Inframedian latus triangular umbo apical, slightly curved toward scutum and projecting above rostrolatus. Carinolatus higher than rostrolatus, umbo just below mid-point on carinal margin. Stalk with wide scales.

Taxonomic remarks The current specimens have a larger apical extension on the upper latus than those in the original description and appear similar to *A. mamillatum* as figured by (Young, 2007), however other accounts of both species again show some differences from the original description. Unfortunately, the type specimens are represented by only a few disarticulated plates (Shalaeva & Boxshall, 2014).

Distribution Indian and Pacific Oceans. 2350–4162 (IOT records 2617–3078 m).

Ecology and life history Potentially epizoic, attached to gorgonians and crinoids.

***Catherinum australicum* (Hoek, 1883)**

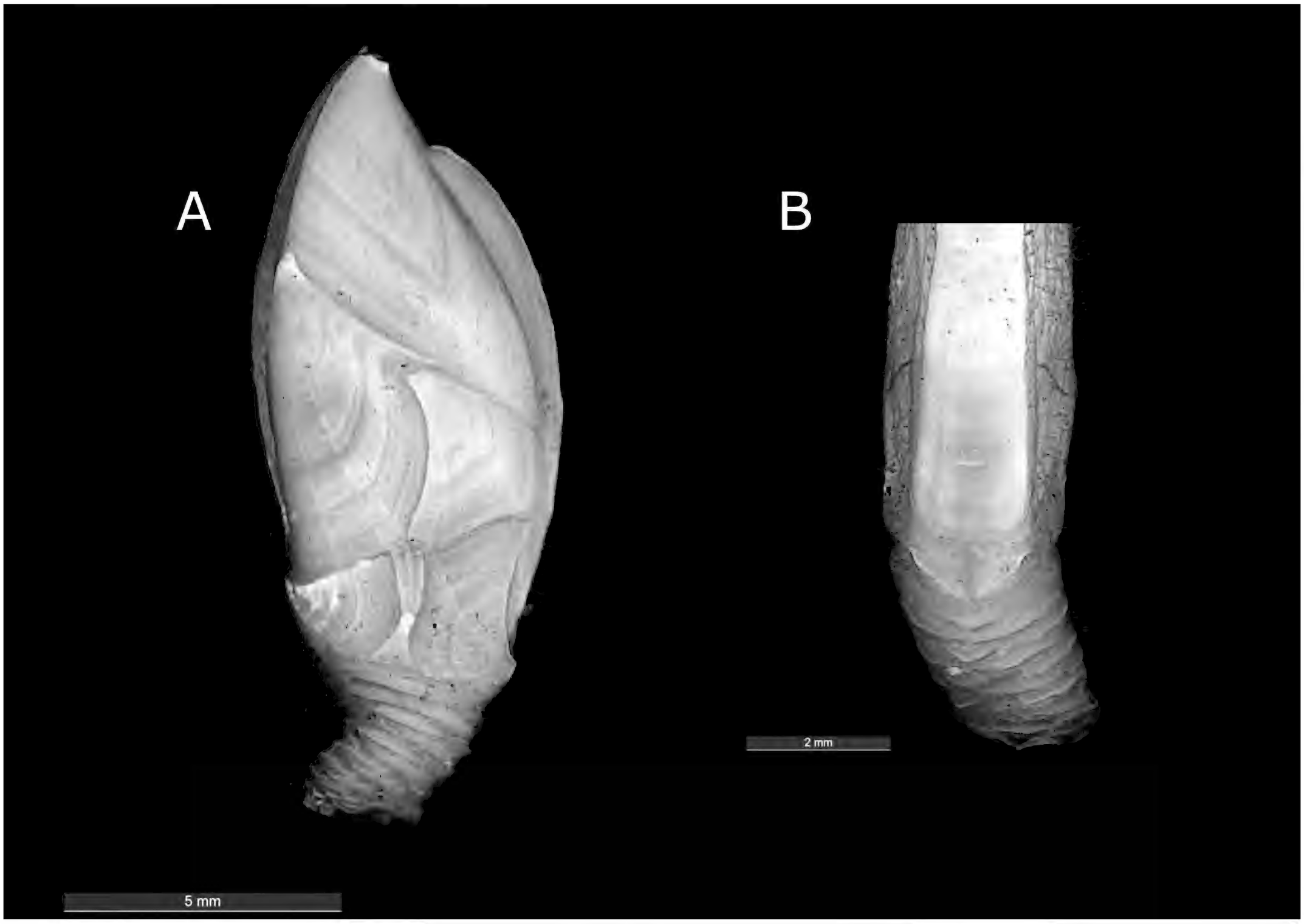

Figure 25. *Catherinum australicum*. WAM C80033 (Op 145) (A) lateral view and (B) carinal view showing junction between carinolatera.

Diagnosis Capitulum with 14 radially striated plates, without membranous interspaces. Carina roof flat, bounded by faint lateral ridges in basal part, apex extending to distal third of tergum. Upper latus umbo apical, inserting into notch on scutum. Inframedian latus with central umbo, narrow. Carinolatus higher than rostrolatus, junction between carinolateral weakly interdigitating.

Taxonomic remarks The IOT specimens have a generally less developed sculpture of striations of the capitular plates as well as a narrower inframedian latus compared to the holotype photographed by (Shalaeva & Boxshall, 2014). In this respect the present specimens come close to *C. decorus* and *C. galatheanum*, the latter of which lacks the radial sculpture.

Distribution Indian and west Pacific Oceans. 463–2563 m (IOT records 3002–3078 m).

Ecology and life history These records extend the known depth of this species to >3000 m. Females have been recorded hosting up to six dwarf males within a membranous pocket on the inside of the scutum (Jones, 1992).

Catherinum constrictum (Foster & Buckeridge, 1995)

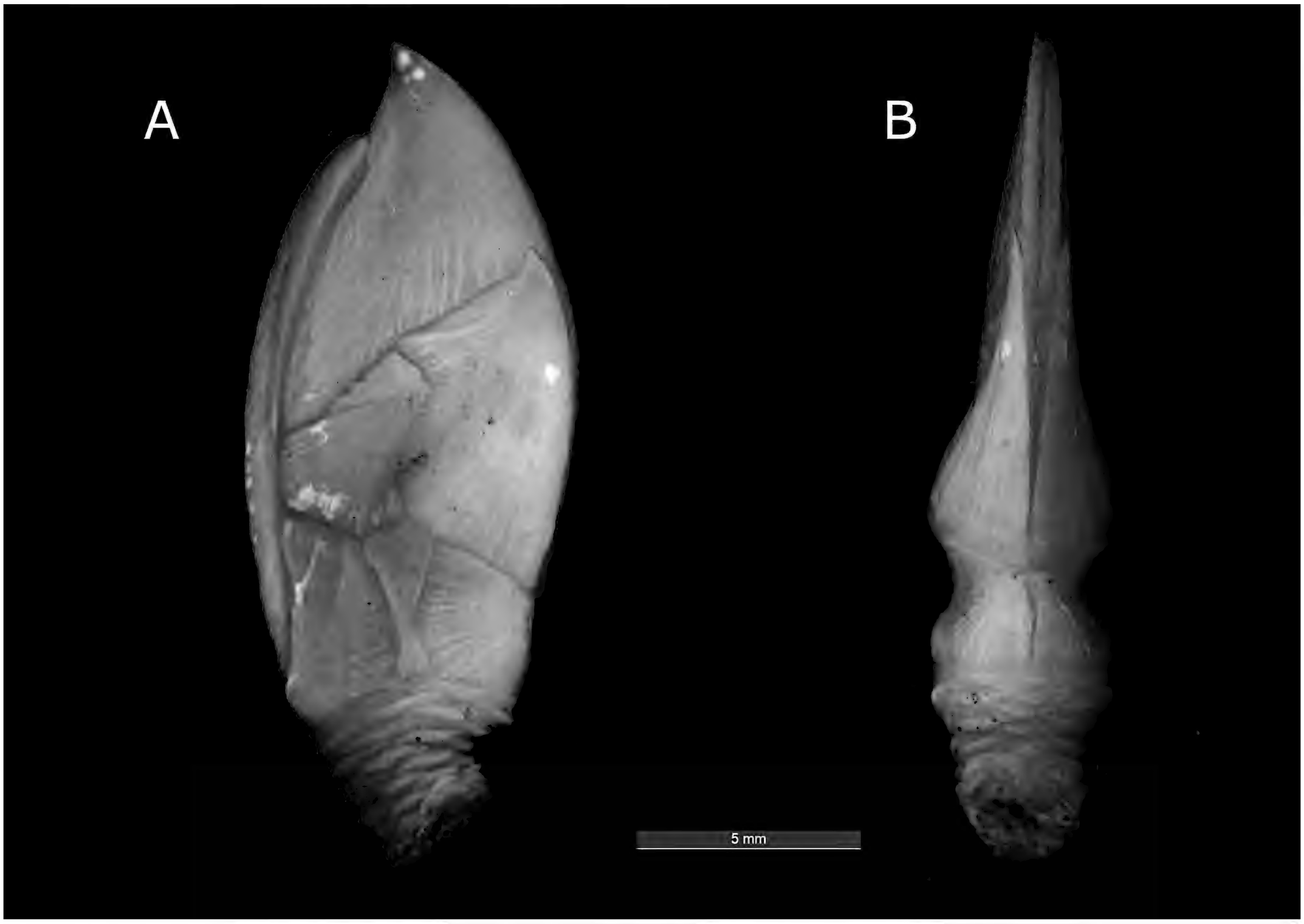

Figure 26. *Catherinum constrictum*. WAM C82294 (Op 181) (A) lateral and (B) rostral view showing the distinct constriction in the lower part of the capitulum.

Diagnosis Capitulum with 14 radially striated plates, without membranous interspaces. Carina roof flat, bounded by lateral ridges, apex extending to distal third of tergum. Upper latus umbo subapical, displaced by secondary apical extension. Inserting into notch on scutum. Inframedian latus with central umbo, upper part wider than base. Carinolatus higher than rostrolatus. Plates of lower whorl distinctly constricted to give a 'waisted' appearance.

Taxonomic remarks In lateral view this species closely resembles many of the species in the genus and the constriction of the capitulum below the scutum is the key distinguishing feature.

Distribution Indian Ocean. 2850–3520 m (IOT records 2889–2923 m).

Ecology and life history The specimen collected from IOT is the first since this species was described from near La Réunion and extends the known geographic range to the eastern Indian Ocean.

Catherinum trapezoideum (Hoek, 1907)

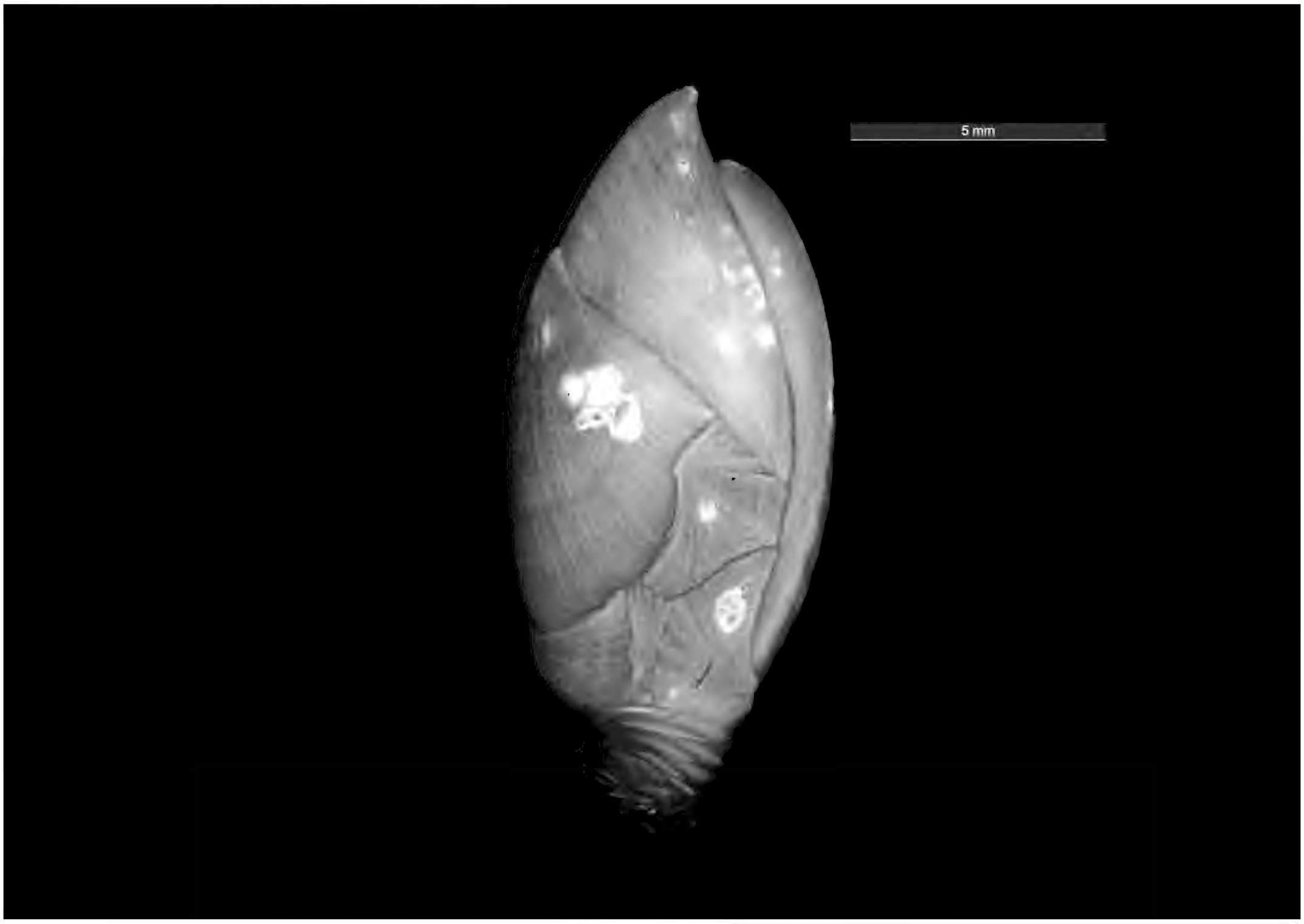

Figure 27. *Catherinum trapezoideum*. WAM C80018 (Op 151), lateral view.

Diagnosis Capitulum with 14 radially striated plates, without membranous interspaces. Carina roof flat, bounded by lateral ridges, apex extending beyond distal third of tergum. Upper latus umbo subapical, displaced by large secondary apical extension. Inserting into slight notch on scutum. Inframedian latus with central umbo, nearly parallel sided. Carinolatus higher than rostrolatus.

Taxonomic remarks The position of the upper latus umbo in the figured specimen is almost central on the scutal margin and approaching the condition seen in *Planoscalpellum distinctum*. In this species however, the capitulum is much less sculptured, the inframedian latus is much broader in the distal half and the stalk is covered in approximately 10 columns of small scales (Shalaeva & Boxshall, 2014).

Distribution Atlantic and eastern Indian Oceans. 2496–2796 m (IOT records 3053–3144 m).

Litoscalpellum **sp. 1**

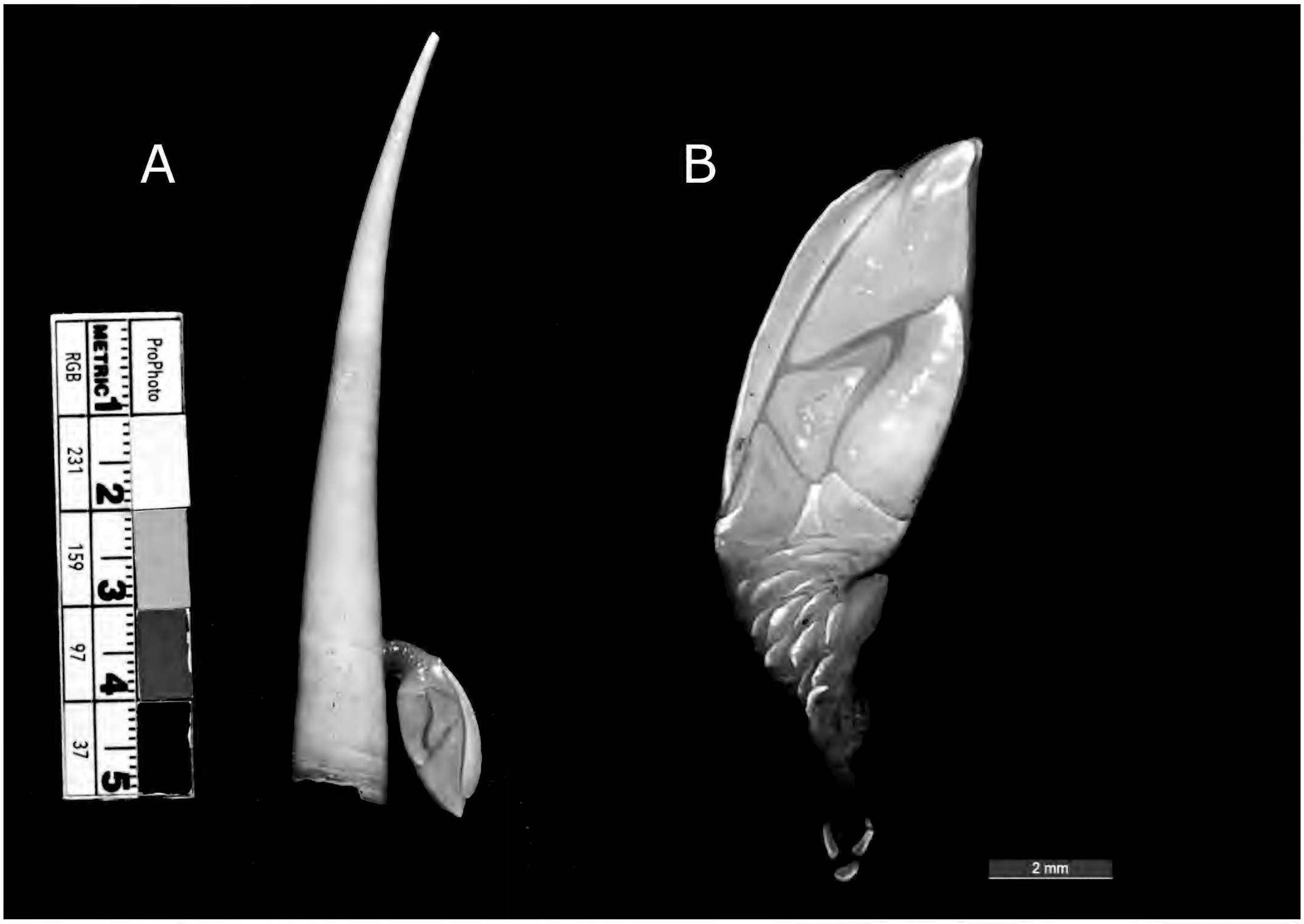

Figure 28. *Litoscalpellum* sp. 1. (A) WAM C78487 (Op 031) attached to scaphopod shell and (B) WAM C82295 (Op 116) lateral view.

Diagnosis Capitulum with 14 smooth plates with membranous interspaces in larger specimens. Upper latus umbo subapical, displaced from margin by secondary apical extension to the plate. Scutum with concavity on lateral margin to accommodate upper latus. Carina almost straight with a flat roof bounded by longitudinal ridges. Inframedian latus triangular with apical umbo reaching upper latus.

Taxonomic remarks These specimens are similar to *Litoscalpellum intermedium* but a key difference is that the tergum in *L.* sp. 1 is not excavated on the basal margin and not forming an inverted V-shape as it does in *L. intermedium*. However, the ontogenetic increase in size makes assigning individuals to species difficult if they are not full sized and it is possible that the IOT specimens are yet to start the reduction of the tergum. As molecular data for scalpellids becomes more prevalent it has been speculated that many species with reduced plates are likely to be proven to be ontogenetic variations of each other resulting in a significant number of synonymies.

Distribution IOT records 1042–1140 m.

Ecology and life history Both specimens collected on the expeditions were attached to scaphopods (tusk shells) and were oriented down towards the aperture.

plate reduction as members of this group of barnacles

Neoscalpellum cf. *marginatum* (Hoek, 1883)

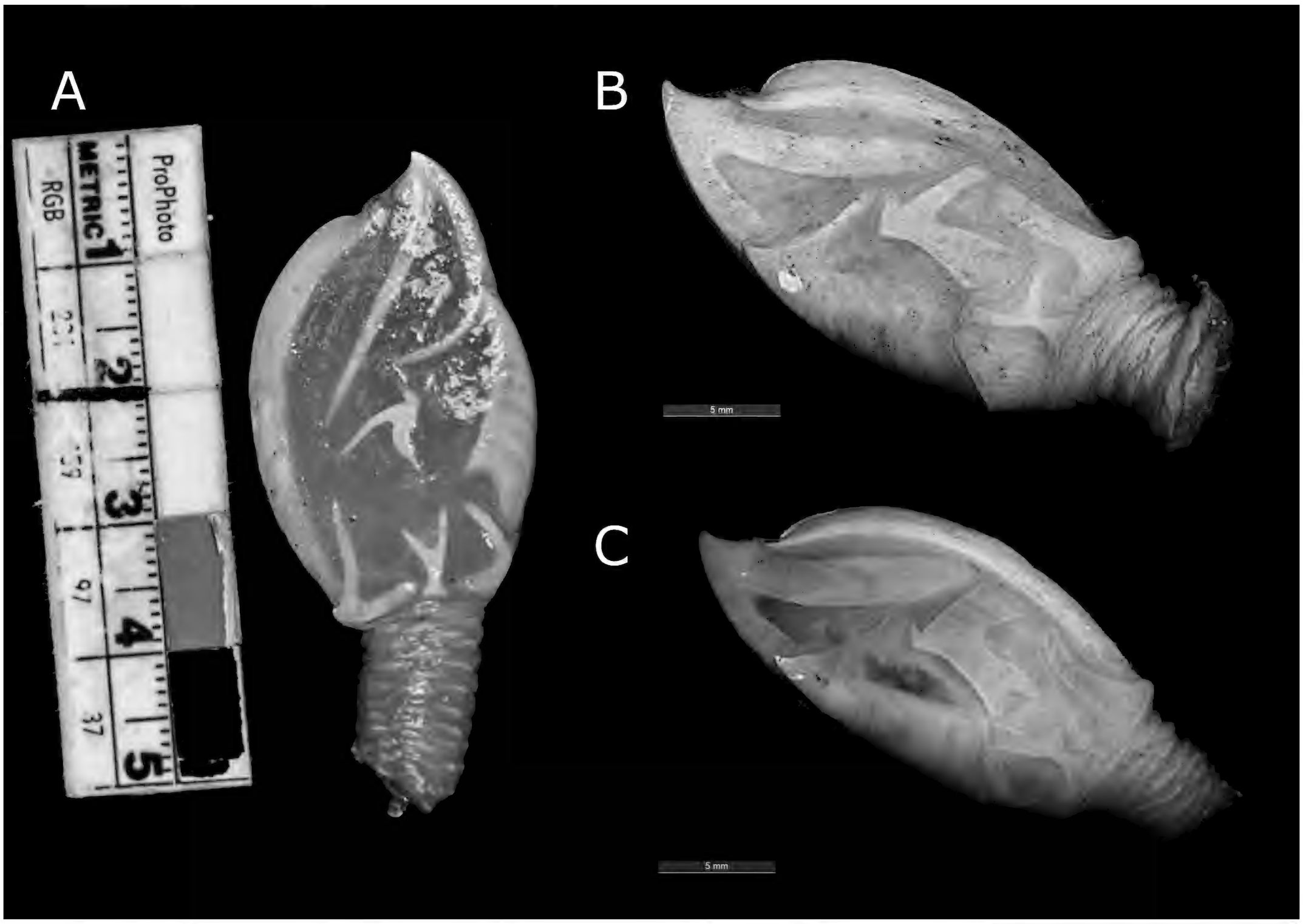

Figure 29. *Neoscalpellum* cf. *marginatum*. Specimens showing variation in shell reduction: (A) WAM C78479 (Op 028) CL 33 mm female, (B) WAM C82297 (Op 181) CL 22 mm female, and (C) WAM C80017 (Op 151) CL 19 mm female.

Diagnosis Capitulum with 13 smooth plates with very large membranous interspaces in larger specimens. Rostrum absent. Carina with sub-apical umbo, displaced by short secondary extension, roof bounded by prominent lateral ridges creating deep longitudinal groove. Tergum branched forming an inverted V-shape, both branches narrow, especially in large specimens. Scutum with long tergal arm, basal margin concave. Carinolatus becoming L-shaped, inframedian latus becoming Y-shaped as specimens get larger.

Taxonomic remarks The extreme changes in the morphology of the capitular plates during ontogeny make assigning members of this genus to species difficult. Only a few species have had these ontogenetic reductions documented (Young, 1998, 2007) but more detail on intra- and interspecific variation backed with molecular data will be needed to draw species boundaries more accurately. The present collection contains large adult specimens as well as tentatively identified small juveniles.

Distribution Indian and western Pacific. 1600–4850 m (IOT records 1640–4990 m).

Ecology and life history It is unclear what the adaptive significance of the plate reduction is in this, and related, genera however, *Neoscalpellum* are typically abyssal species, and it may have evolved as a strategy to deal with the decreased availability of calcium carbonate at these depths.

Planoscalpellum sp. 1

Figure 30. *Planoscalpellum* sp. 1. WAM C82299 (Op 147) lateral view.

Diagnosis Capitulum with 14 plates with fine but distinct radial striations. Scutum triangular. Carina evenly bowed. Upper latus pentagonal, with umbo centrally on scutal margin. Inframedian latus triangular with central umbo. Rostrolatus higher than wide, scutal margin peaked where it meets upper latus margin giving a trapezoidal appearance. Carinolatus umbo sub-basal.

Taxonomic remarks This species is similar to *P. planum*, *P. limpidus* and *P. hexagonum* in the shape and arrangement of the shell plates, however, none of these species bear the radial striations seen in the present specimen. More specimens are needed to determine if the fine striations seen in the present specimen are consistent.
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Distribution IOT records 2617–2721 m.

Regioscalpellum gigas (Hoek, 1883)

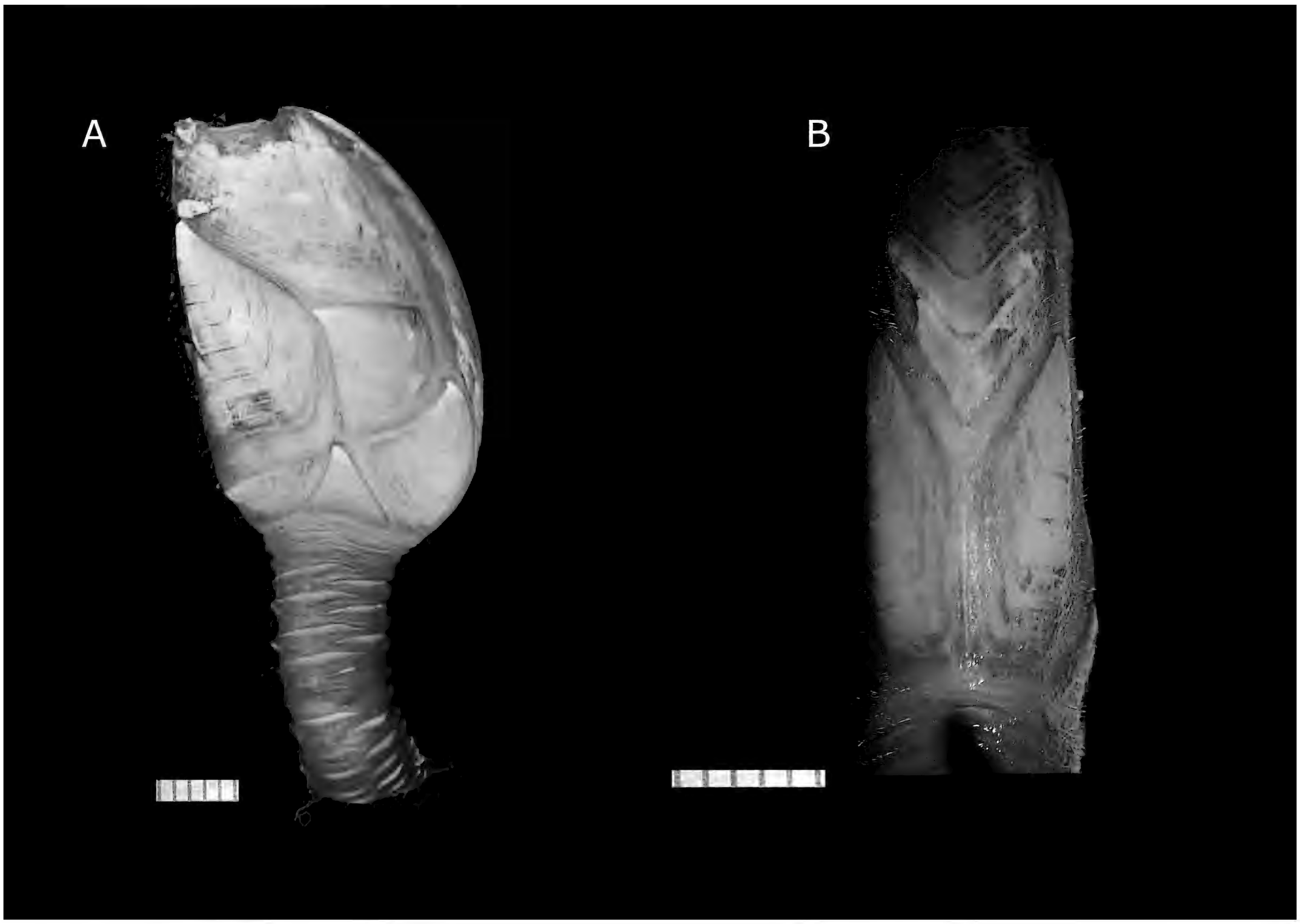

Figure 31. *Regioscalpellum gigas*. WAM C80011 (Op 122) (A) lateral view and (B) carinal view showing simple junction between carinolateral. Scale bar = 5 mm.

Diagnosis Capitulum with 14 smooth plates, epidermis with short setose 'pile' obscuring shell plates where not worn smooth. Carina simply arched, roof flat or slightly convex without lateral ridges. Rostrolatus broader than high; inframedian latus triangular, equilateral, umbo apical. Carinolatus umbo apical, curved upward toward tergum, both plates meeting under carina for just under half height of carinolatus before diverging to apex. Stalk may be longer than capitulum, peduncular scales broad, deeply set in integument.

Taxonomic remarks Members of this genus have often been confused in the literature and the species were revised with a key provided by Young (1998). The morphological distinctions of this group are subtle and should be tested with molecular evidence as unpublished genetic data is also showing that there are divergent lineages in different ocean basins. The form of the carinolatus distinguishes this species from most members of the genus, the junction of the two carinolatera mean the carina is seated higher up the capitulum than that of the similar species *R. regium* or *Trianguloscalpellum darwini*.

Distribution Indian and western Pacific. 3310–4820 m (IOT records 3200–4900 m).

Ecology and life history This very large species attaches to rocks, glass sponge spicules or exposed coral skeleton.

Trianguloscalpellum hirsutum **(Hoek, 1883)**

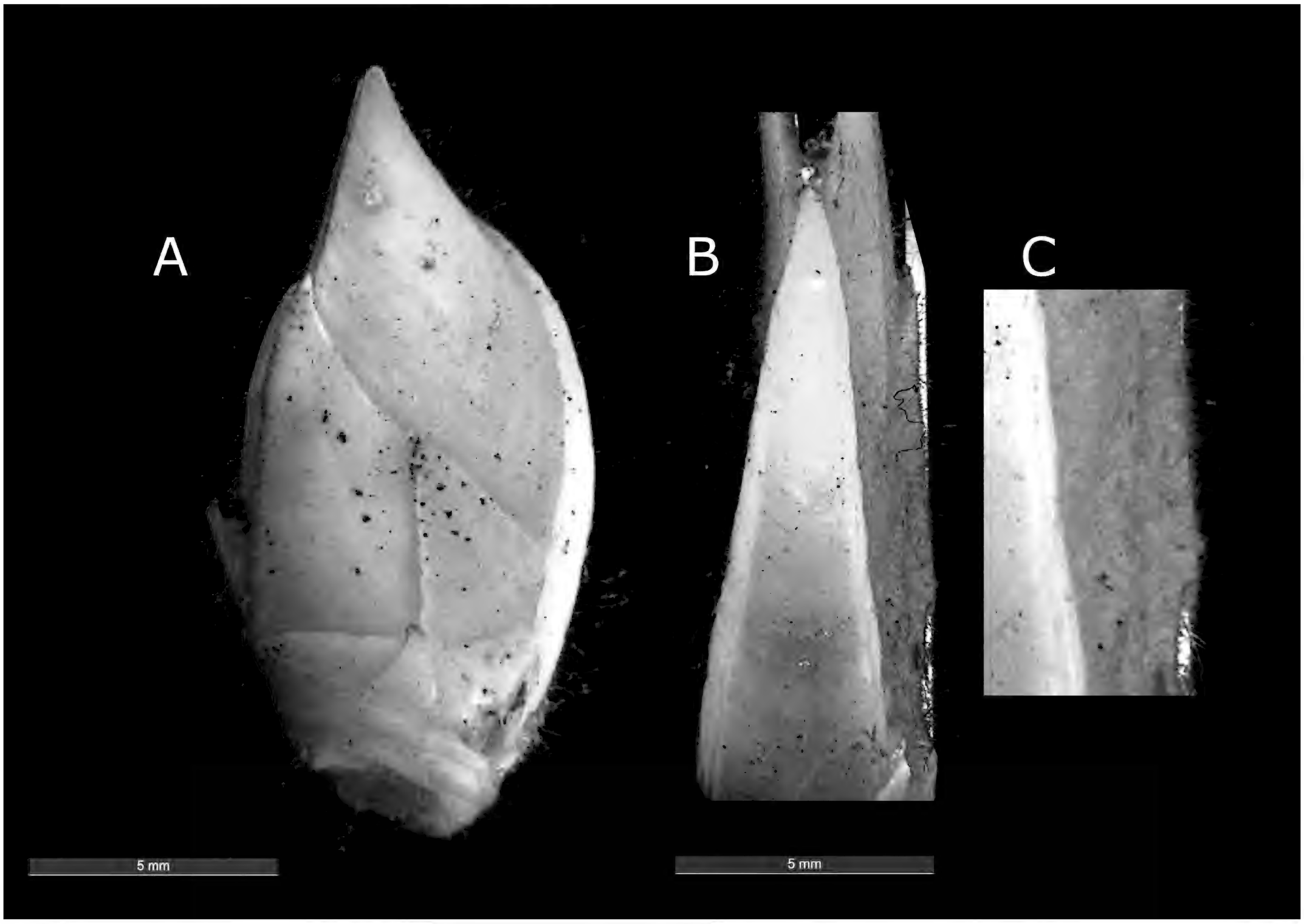

Figure 32. *Trianguloscalpellum hirsutum*. WAM C80025 (Op 147) specimen (A) lateral view, (B) carinal view, and (C) close up of edge of capitulum showing long setae (hairs).

Diagnosis Capitulum with 14 smooth plates, epidermis with long, dense setae. Carina simply arched, roof flat or slightly convex without lateral ridges. Rostrolatus broader than high; inframedian latus triangular, equilateral, umbo apical. Carinolatus umbo produced and curved upward toward carina, junction of both plates simple, not interdigitating.

Taxonomic remarks The holotype of this species was a small, probably juvenile specimen and is considered lost (Shalaeva & Boxshall, 2014). Although it is currently assigned to a different genus the plate arrangement is very similar to *A. michelottianum*, with the hirsute capitulum being a key distinguishing feature.

Distribution Indian and Pacific Oceans. 1502–1965 m (IOT records 2617–2721 m).

Order Verrucomorpha

Family Verrucidae

Altiverruca casula **(Hoek, 1913)**

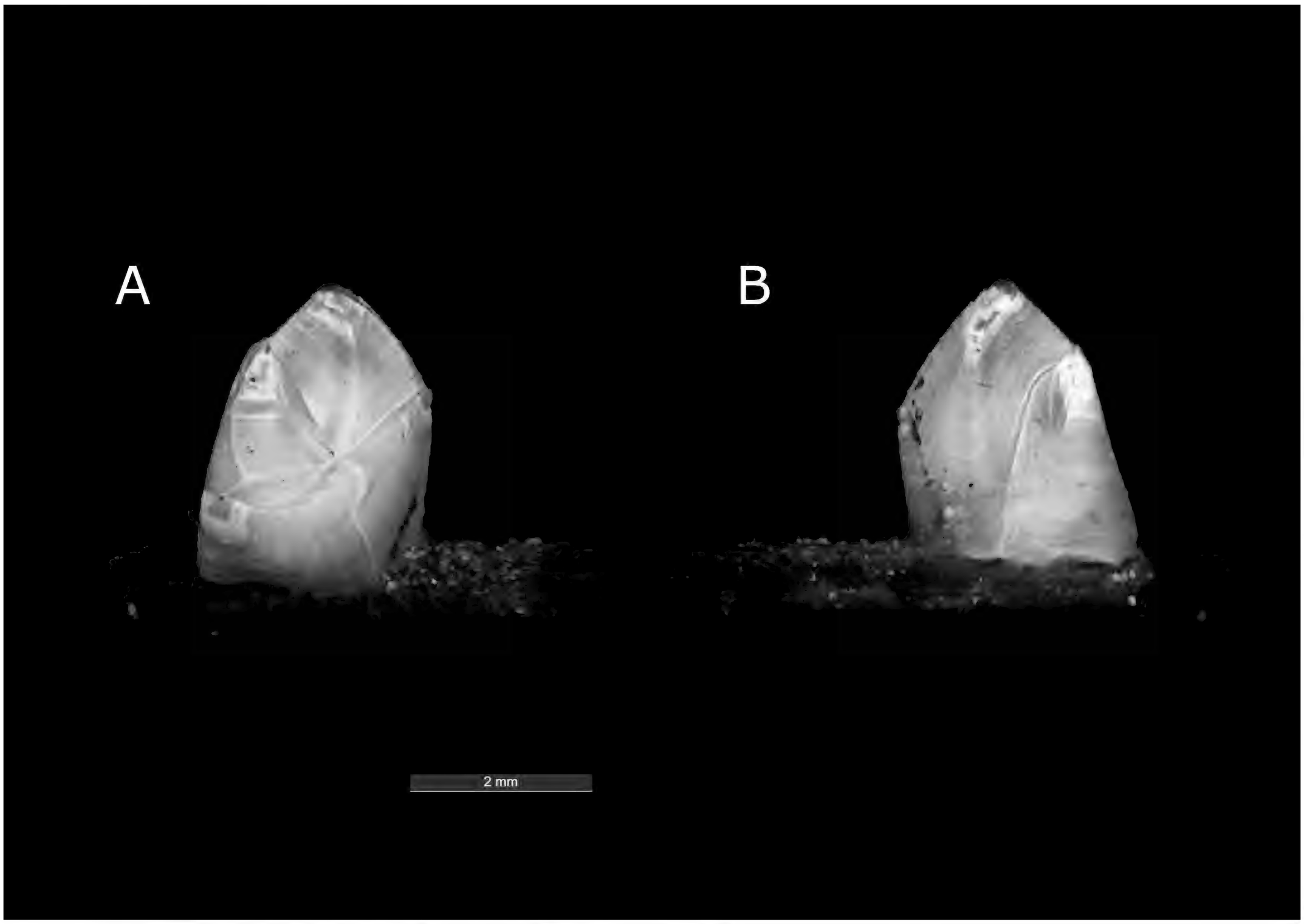

Figure 33. *Altiverruca casula*. WAM C78421 (Op 009) attached to glass sponge spicules. (A) frontal view showing rostrum-carina articulation and moveable opercular plates (B) rear view showing fixed opercular plate.

Diagnosis Shell wall asymmetrical with rostrum and carina forming front wall and fixed scutum and tergum forming the back wall. Operculum formed by moveable scutum and tergum creating a 'lid'. Shell erect, fixed tergum and scutum approximately twice as tall as carina and rostrum, respectively. Moveable opercular plates inclined, approaching perpendicular to substrate, (~70–80°). Shell sculpture simple, growth lines indistinct, articular suture between rostrum and carina with one large rostral rib. Moveable scutum with two longitudinal ridges, moveable tergum with one distinct longitudinal ridge. Rostrum with smooth flattened area between articular rib and scutum. Lacking adductor ridge or myophore on fixed scutum.

Taxonomic remarks This species can be separated from *Altiverruca* sp. 1, below, by the much smoother shell. In *Altiverruca* sp. 1, the growth lines are prominent and the area between the rostral articular rib and the scutum is rugose. Species assigned to this genus are typically very small and lack strong sculpture or multiple articular ribs, making them rather simple in construction compared to genera such as *Metaverruca* and *Gibbosaverruca*.

Distribution Western Pacific Ocean, Ceram Sea. 924 m (IOT records 957–1595 m).

Ecology and life history The IOT specimens were collected attached to glass sponge spicules.

Altiverruca **sp. 1**

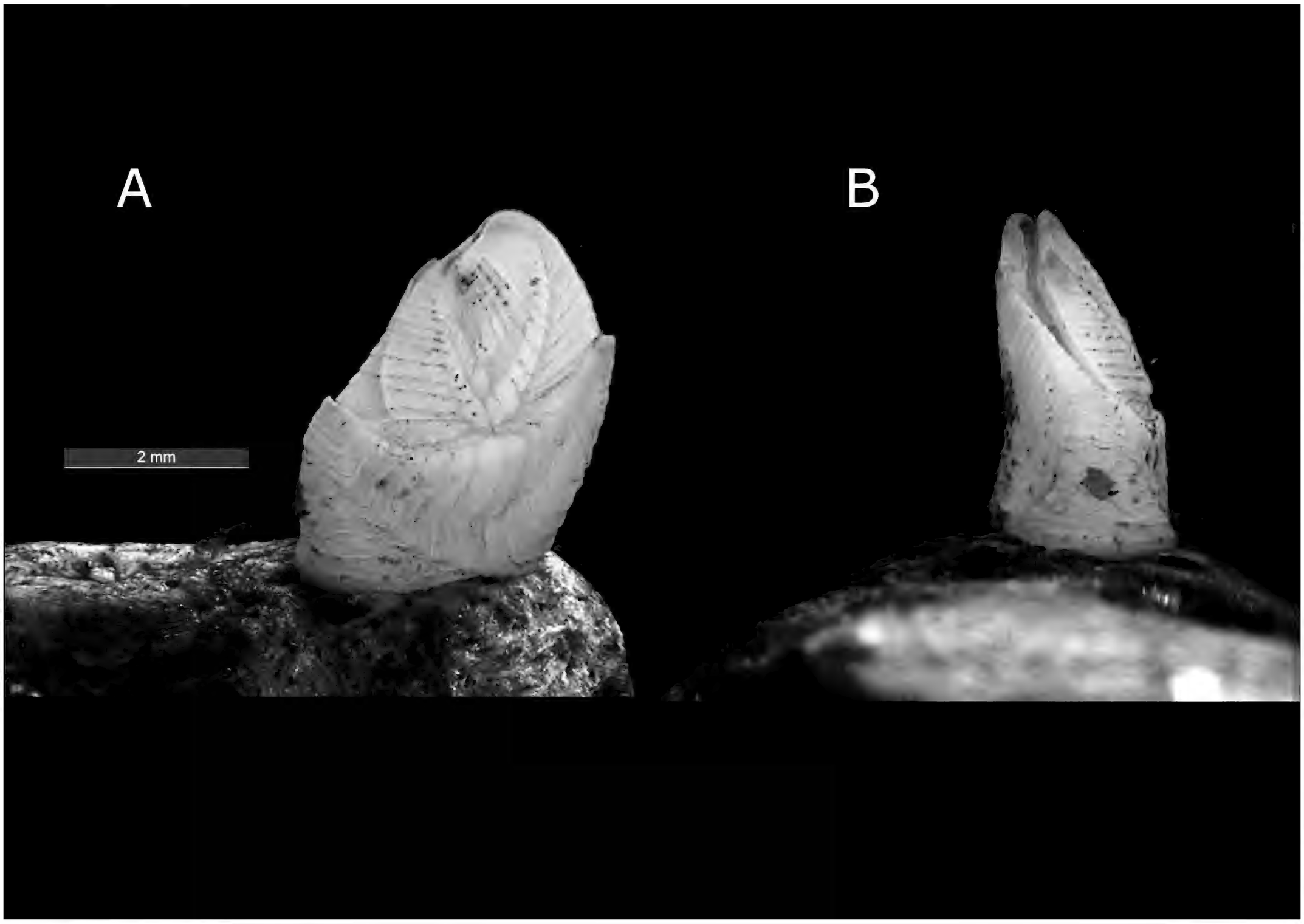

Figure 34. *Altiverruca* sp. 1. WAM C82305 (Op 105) individual attached to pumice (A) frontal and (B) rostral view showing the near vertical orientation of the moveable opercular plates in this genus.

Diagnosis Shell wall asymmetrical with rostrum and carina forming front wall and fixed scutum and tergum back wall. Operculum of moveable scutum and tergum forming 'lid'. Shell erect, fixed tergum and scutum approximately twice as tall as carina and rostrum, respectively. Moveable opercular plates inclined, approaching perpendicular to substrate (~70–90°). Shell sculpture simple, growth lines distinct, articular suture between rostrum and carina with one large rostral rib. Moveable scutum with 2 longitudinal ridges, moveable tergum with one distinct and one partial longitudinal ridge. Rostrum with rugose flattened area between articular rib and scutum. Lacking adductor ridge or myophore on fixed scutum.

Taxonomic remarks The specimens assigned to *Altiverruca* sp. 1 show some variation in the shape of the articular rib on the rostrum, with the pictured specimen showing a broad truncated rib compared to the rounded rib of *A. casula*. The ridge-like growth lines are always distinct and can be used to immediately distinguish this species from *A. casula*. The distinction between *Altiverruca* and *Gibbosaverruca* is that the latter genus has numerous articular ribs between rostrum and carina as opposed to the single or indistinct rib for *Altiverruca* (Young, 2002), *Gibbosaverruca* species are also typically larger (> 5mm diameter).

Distribution IOT records 603–2721 m.

Ecology and life history Theses specimens were attached to rocks, including pumice, and gastropod shells.

Cameraverruca sp. 1

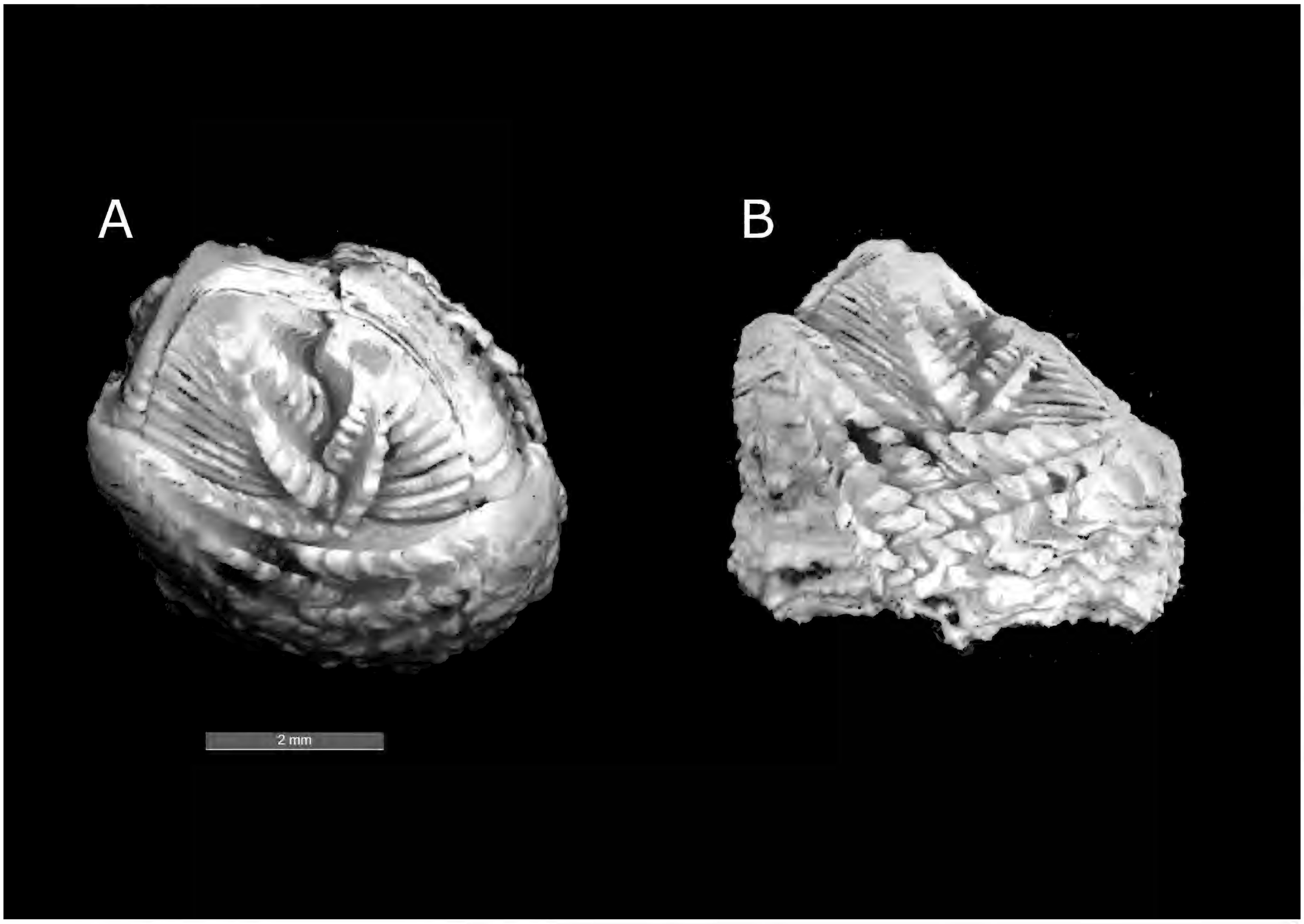

Figure 35. *Cameraverruca* sp. 1. WAM C77911 (Op 037) (A) top down and (B) frontal view.

Diagnosis Shell wall asymmetrical with rostrum and carina forming front wall and fixed scutum and tergum back wall. Operculum of moveable scutum and tergum forming 'lid'. Shell depressed, fixed tergum and scutum taller than carina and rostrum, respectively. Moveable opercular plates inclined, to approximately 45°. Shell sculpture prominent, growth lines distinct, articular suture between rostrum and carina with four ribs, apical rib only slightly larger than remainder. Moveable scutum with three longitudinal ridges, moveable tergum with three distinct longitudinal ridges. Rostrum and carina apices marginal. Fixed scutum with adductor ridge or myophore.

Taxonomic remarks These specimens are only tentatively assigned to this genus and may represent an aberrant *Metaverruca* or *Newmaniverruca*. A key character for this genus is the internal cavities on the fixed scutum and tergum, which in this species do not appear to be well developed.

Distribution IOT records 754–1968 m.

Ecology and life history These specimens were attached to rocks and corals.

Costatoverruca sp. 1

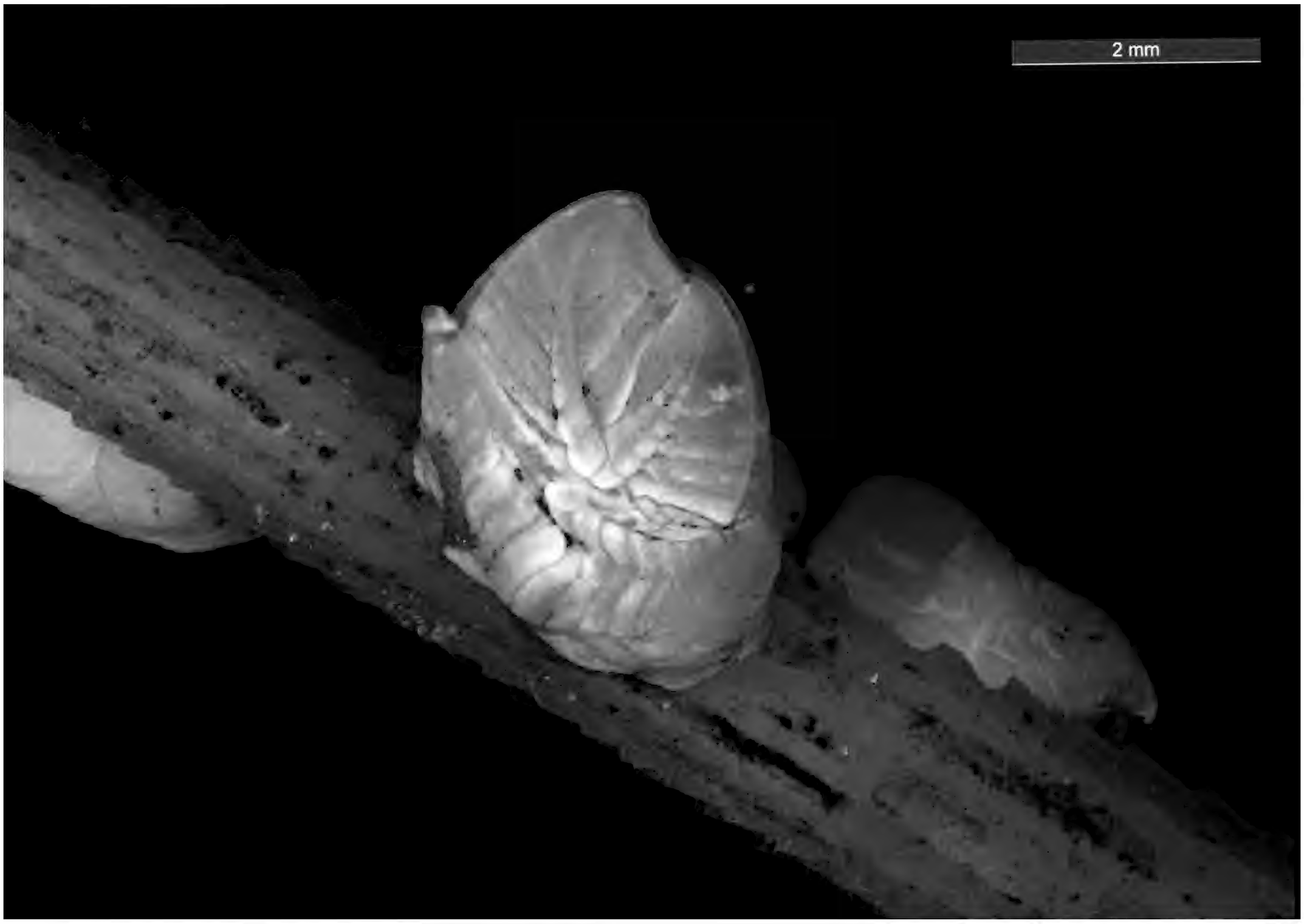

Figure 36. *Costatoverruca* sp. 1. WAM C82311 (Op 163) top-down view of an individual attached to an echinoid spine.

Diagnosis Shell wall asymmetrical with rostrum and carina forming front wall and fixed scutum and tergum back wall. Operculum of moveable scutum and tergum forming 'lid'. Shell depressed, fixed tergum and scutum not much taller than carina and rostrum, respectively, if at all. Moveable opercular plates almost horizontal, inclined much less than 45°. Shell sculpture prominent, growth lines distinct, articular suture between rostrum and carina with one rib. Rostrum with secondary ridges above articular rib that run towards scutum. Moveable scutum with two longitudinal ridges, moveable tergum with two distinct longitudinal ridges separated by wide convex interspace. Rostrum and carina apices marginal. Fixed scutum with adductor ridge or myophore.

Taxonomic remarks This species is similar to *C. cornuta*, however, it is not clear if the tergum of the present specimens has three ridges as the space between the central and marginal rib is gently rounded and not exactly demarcated as a ridge. Another point of difference is that the secondary ridges, that are directed towards the scutum are not very strong, and have created a sinuous basal margin on the scutum where they interlock but not longitudinal ridges.
Distribution IOT records 527–528 m.
Ecology and life history These specimens were attached to the spines of an echinoid.

Gibbosaverruca nitida (Hoek, 1883)

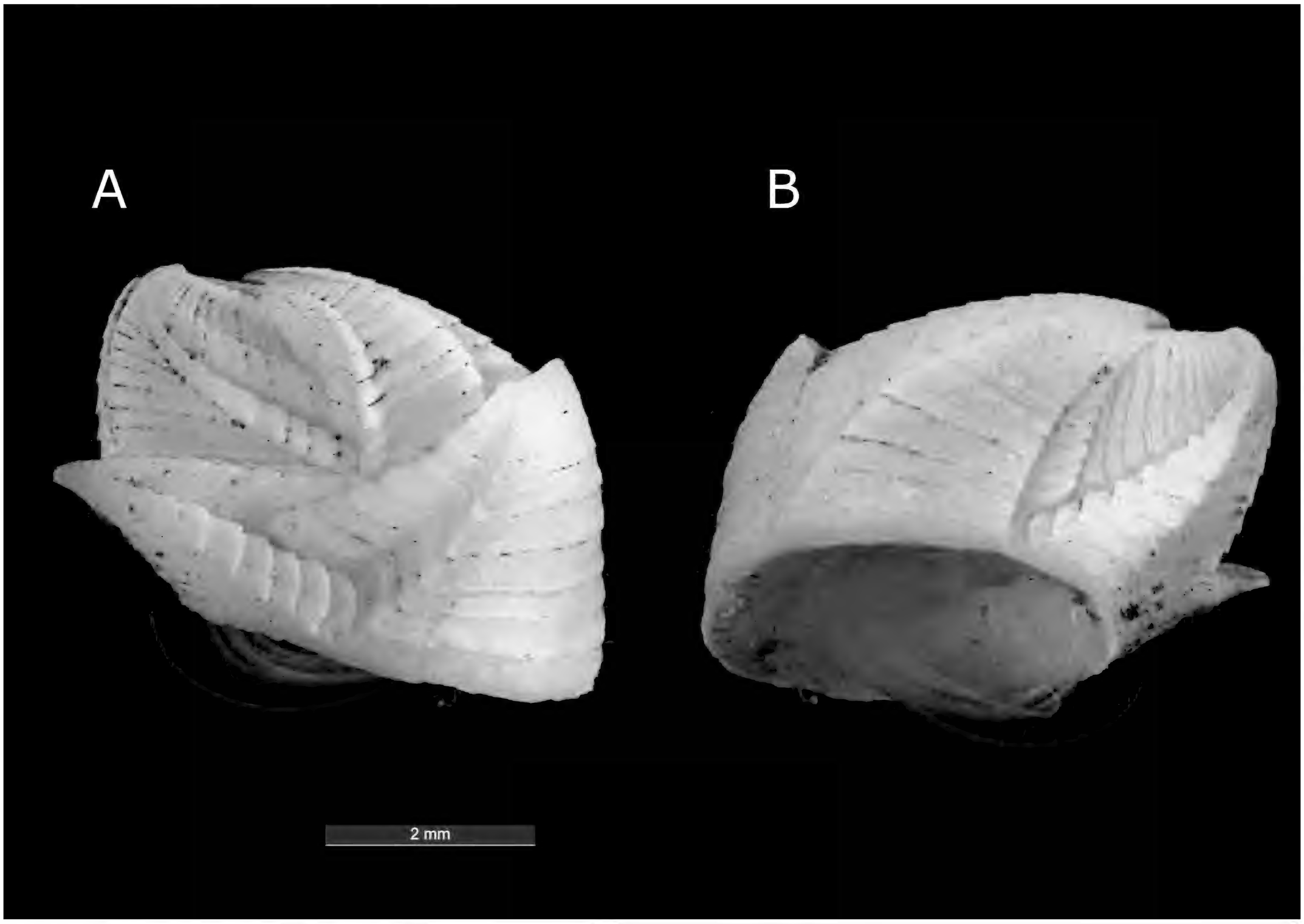

Figure 37. *Gibbosaverruca nitida*. WAM C82312 (Op 153)(A) frontal and (B) rear view.

Diagnosis Shell wall asymmetrical with rostrum and carina forming front wall and fixed scutum and tergum back wall. Operculum of moveable scutum and tergum forming 'lid'. Shell erect, fixed tergum and scutum approximately twice as tall as carina and rostrum, respectively. Moveable opercular plates inclined, approaching perpendicular to substrate (~70–80°). Shell sculpture simple, growth lines distinct, articular suture between rostrum and carina with one large rostral rib. Moveable scutum with 2 longitudinal ridges, moveable tergum with three distinct longitudinal ridges. Rostrum and carina apices marginal, protruding from shell outline. Lacking adductor ridge or myophore on fixed scutum.

Taxonomic remarks The figured specimen is somewhat flattened in profile and has the appearance of leaning towards the carina, possibly caused by attaching to an inclined substrate. The articular rib which is broad and flat creates a distinct groove in the carina that serves to distinguish this species from most *Gibbosaverruca*. *Gibbosaverruca sulcata*, below, has additional smaller articular ribs below the apical rib.
Distribution Western Pacific. 650–2040 m (IOT records 1736–1990 m).

Gibbosaverruca sulcata **(Hoek, 1883)**

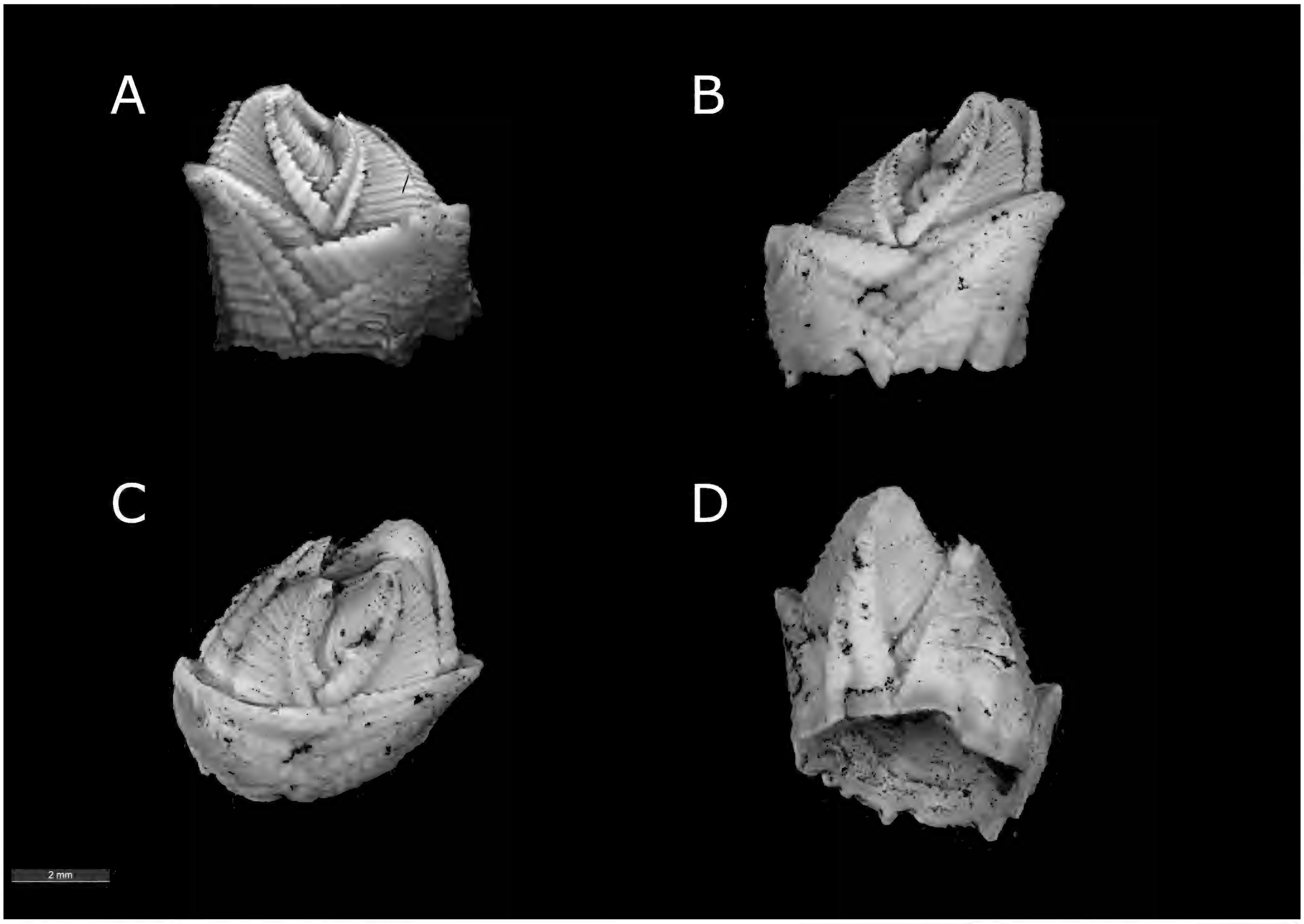

Figure 38. *Gibbosaverruca sulcata*. WAM C82316 (Op 136) (A) frontal view and WAM C82318 (Op 141) (B) frontal, (C) top down, and (D) rear views.

Diagnosis Shell wall asymmetrical with rostrum and carina forming front wall and fixed scutum and tergum back wall. Operculum of moveable scutum and tergum forming 'lid'. Shell erect, fixed tergum and scutum approximately twice as tall as carina and rostrum, respectively. Moveable opercular plates inclined, approaching perpendicular to substrate, ~70–80°. Shell sculpture distinct, growth lines distinct, articular suture between rostrum and carina with three or four ribs, apical rostral rib largest. Moveable scutum with 2 longitudinal ridges, moveable tergum with three distinct longitudinal ridges. Rostrum and carina apex marginal, protruding from shell outline. Lacking adductor ridge or myophore on fixed scutum.

Taxonomic remarks *Gibbosaverruca sulcata* has at various times been considered a synonym of *G. gibbosa* originally described from the southern Atlantic and they are still not very well separated (Young, 2002). Hoek's original descriptions separated these species largely on the free apices of the moveable scutum. Species assigned to this genus are in need of revision.
Distribution Western Pacific. 750–1990 m (IOT records 754–1990 m).
Ecology and life history Attached to a variety of substrates including pumice and corals.

Metaverruca sp. 1

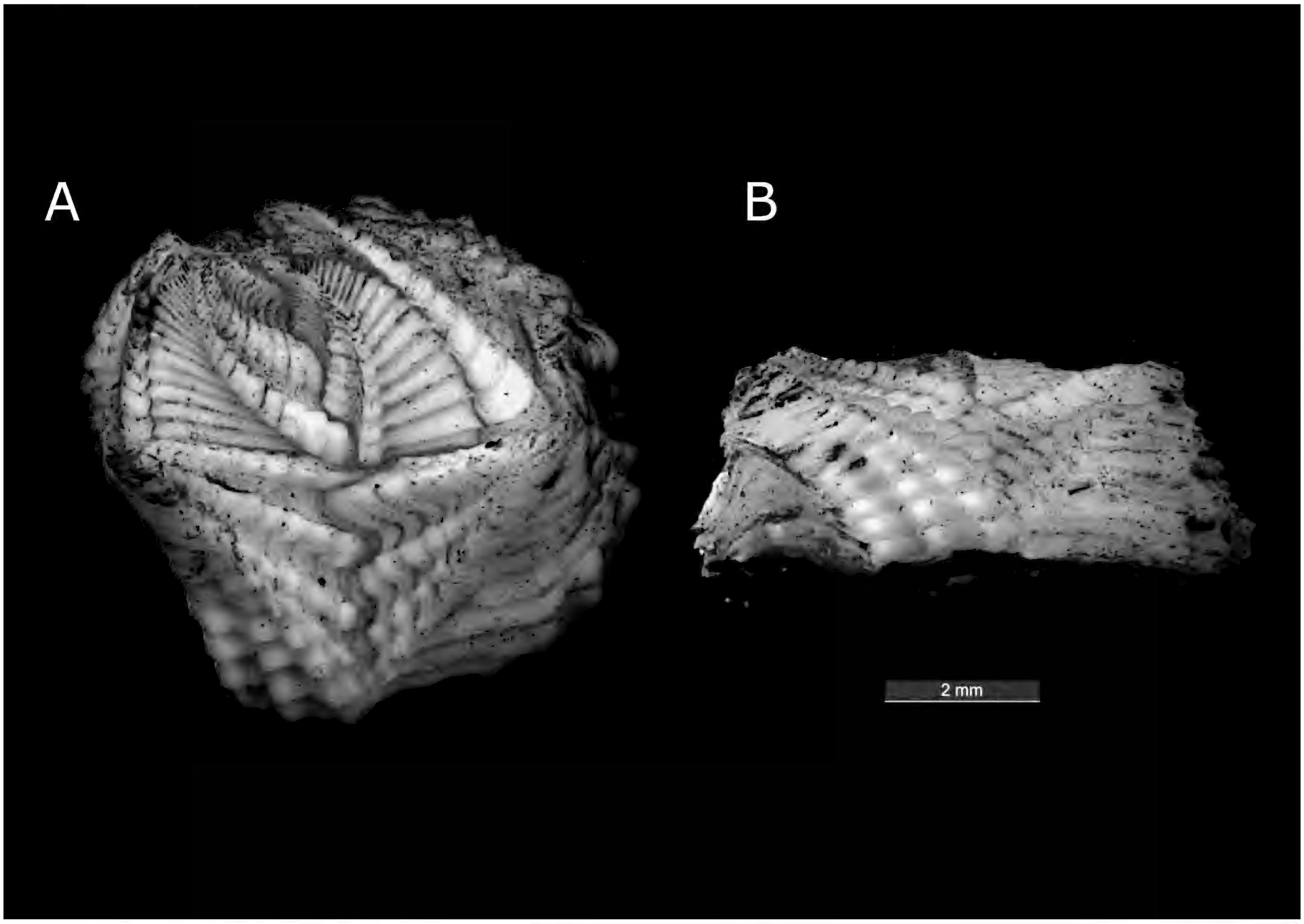

Figure 39. *Metaverruca* sp. 1. WAM C77912 (Op 44) (A) top down and (B) frontal view showing the horizontal nature of the opercular plates.

Diagnosis Shell wall asymmetrical with rostrum and carina forming front wall and fixed scutum and tergum back wall. Operculum of moveable scutum and tergum forming 'lid'. Shell depressed, box-like, fixed tergum and scutum approximately same height as carina and rostrum, respectively. Moveable opercular plates almost horizontal. Shell sculpture prominent, growth ridges distinct, articular suture between rostrum and carina with four ribs, becoming progressively smaller basally. Rostrum and carina with irregular radial ridges. Moveable scutum with three longitudinal ridges, moveable tergum with three distinct longitudinal ridges. Rostrum and carina apices marginal. Fixed scutum with adductor ridge or myophore.

Taxonomic remarks This species is similar to *M. recta*, but the sculpture of the shell is much more prominent than in *M. recta*. Especially the presence of the irregular radial ridges, which brings the current species closer to *M. trisculcata* known from the Azores.

Distribution IOT records 1970–2130 m.

Metaverruca sp. 2

Figure 40. *Metaverruca* sp. 2. WAM C82321 (Op 126) two specimens attached to pumice.

Diagnosis Shell wall asymmetrical with rostrum and carina forming front wall and fixed scutum and tergum back wall. Operculum of moveable scutum and tergum forming 'lid'. Shell depressed, box-like, fixed tergum and scutum approximately same height as carina and rostrum, respectively. Moveable opercular plates inclined but not approaching 45°. Shell sculpture prominent, growth ridges distinct, articular suture between rostrum and carina with four ribs, becoming progressively smaller basally. Rostrum and carina without irregular radial ridges, apices marginal protruding beyond shell outline. Moveable scutum with three longitudinal ridges, moveable tergum with three distinct longitudinal ridges. Fixed scutum with adductor ridge or myophore.

Taxonomic remarks A few characters separate *Metaverruca* sp. 2 from *Metaverruca* sp. 1: the lack of radial ridges on the fixed shell plates, the protruding apices of the rostrum and carina, and the slightly inclined opercular plates. This latter character brings this species close to *Newmaniverruca*.

Distribution IOT records 811–1850 m.

Newmaniverruca sp. 1

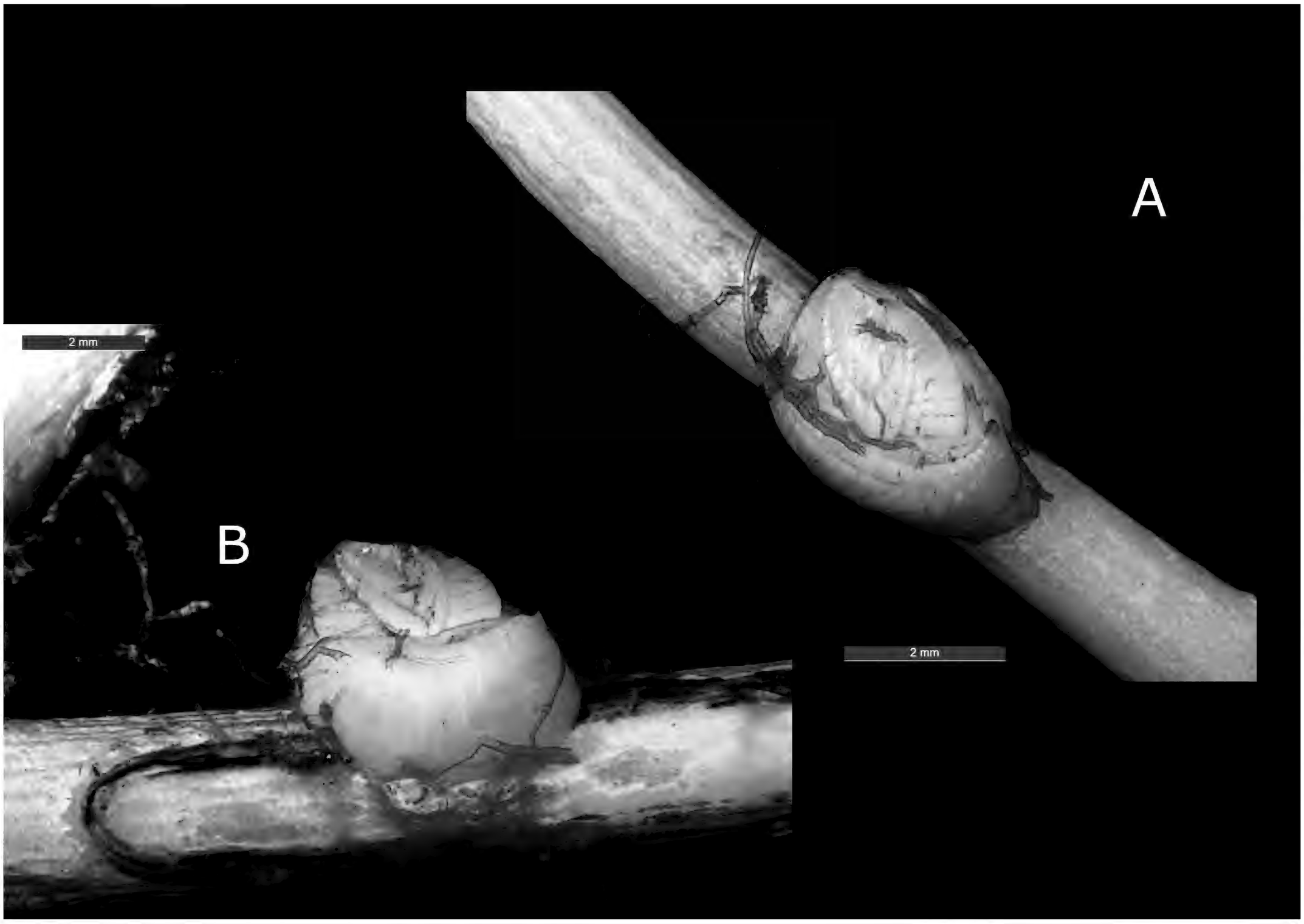

Figure 41. *Newmaniverruca* sp. 1. WAM C78447 (Op 022) two individuals attached to the skeleton of a dead bamboo coral (A) top down and (B) frontal views.

Diagnosis Shell wall asymmetrical with rostrum and carina forming front wall and fixed scutum and tergum back wall. Operculum of moveable scutum and tergum forming 'lid'. Shell depressed, box-like, fixed tergum and scutum approximately same height as carina and rostrum, respectively. Moveable opercular plates at most slightly inclined. Shell sculpture fine, growth ridges distinct, articular suture between rostrum and carina with one distinct rib, becoming sinuous basally. Rostrum and carina without irregular radial ridges, apices marginal. Moveable scutum with three (possibly four) longitudinal ridges, moveable tergum with three distinct longitudinal ridges. Fixed scutum without adductor ridge or myophore.

Taxonomic remarks These specimens are tentatively assigned to *Newmaniverruca* as it seems that the cylindrical coral skeleton to which they are attached has distorted or obscured characters. Comparison utilising DNA sequence data will be very helpful to determine where this species belongs.

Distribution IOT records 1388–1533 m.

Ecology and life history Attached to dead bamboo coral skeleton.

Acknowledgements

This research was supported by a grant of sea time on RV Investigator from the CSIRO Marine National Facility (MNF, https://ror.org/01mae9353); and operational support and funding from Australia's Department of Climate Change, Energy, the Environment and Water through their Parks Australia and Bushblitz programs.

I thank the science staff, MNF personnel and crew of the Investigator voyages IN2021_V04 and IN2022_V08 for their outstanding support of this research. In particular, Tim O'Hara (Museums Victoria) as chief scientist, Melanie Mackenzie (Museums Victoria) and Ana Hara (Western Australian Museum) in their role leading the invertebrate teams at sea and Ana's support and efforts with specimen handling and

processing back onshore. Specimens in Figures 1, 2A & 7A were taken at sea by Nish Nizar (Museums Victoria), and Figures, 16A, 28 A & 29A by Claire Rowe (Australian Museum) and Jeremy Horowitz (Smithsonian Institution). The author acknowledges The Nippon Foundation-Nekton Ocean Census Programme (https://oceancensus.org/) for supporting the discovery and description of these species. The voyages form part of the Second International Indian Ocean Expedition's endorsed project IIOE2-EP40.

Thanks are also due to Maggie Haines at Museums Victoria who efficiently undertook the LaTeX markup and other editing duties for this manuscript at short notice.

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Appendix - Cirripedia from voyages IN2021_V04 and IN2022_V08 to the Australian Christmas Island and Cocos (Keeling) Islands Territories

Family	Species	Operation	Accession no.	Specimen no.	Registration no.*
Balanidae	*Megabalanus* sp.	103	136	4	WAM C82257
Balanidae	*Solidobalanus hawaiensis*	172	108	4	WAM C80012
Balanidae	*Solidobalanus hawaiensis*	172	108	1	WAM C80013
Balanidae	*Solidobalanus hawaiensis*	172	108	1	WAM C80014
Balanidae	*Solidobalanus hawaiensis*	128	145	4	WAM C80021
Balanidae	*Solidobalanus pseudauricoma*	18	107	1	WAM C78599
Balanidae	*Solidobalanus pseudauricoma*	18	107	1	WAM C78600
Balanidae	*Solidobalanus pseudauricoma*	172	108	1	WAM C80015
Balanidae	*Solidobalanus pseudauricoma*	128	145	1	WAM C80022
Calanticidae	*Smilium acutum*	26	113	1	WAM C78459
Calanticidae	cf. *Scillaelepas* sp.	187	113	1	WAM C82259
Heteralepadidae	*Heteralepas* cf. *newmani*	128	149	2	WAM C82260
Heteralepadidae	*Heteralepas* cf. *newmani*	16	102	45	WAM C78437
Heteralepadidae	*Heteralepas* cf. *newmani*	16	121	1	WAM C78439
Heteralepadidae	*Heteralepas* cf. *newmani*	16	122	1	WAM C78440
Heteralepadidae	*Paralepas* sp. 1	5	161	1	WAM C77900
Heteralepadidae	*Paralepas* sp. 1	5	161	1	WAM C77901
Heteralepadidae	*Paralepas* sp. 1	5	161	24	WAM C78409
Lepadidae	*Lepas pectinata*	117	131	1	WAM C82261
Lepadidae	*Lepas pectinata*	141	171	1	WAM C82262
Poecilasmatidae	*Minyaspis aurivillii*	128	119	1	WAM C82263
Poecilasmatidae	*Glyptelasma* cf. *rectum*	155	137	1	WAM C82264
Poecilasmatidae	*Glyptelasma gracile*	18	107	1	WAM C77904
Poecilasmatidae	*Glyptelasma orientale*	22	110	1	WAM C77907
Poecilasmatidae	*Glyptelasma orientale*	9	132	1	WAM C77915
Poecilasmatidae	*Glyptelasma orientale*	9	132	1	WAM C78422
Poecilasmatidae	*Glyptelasma orientale*	22	110	2	WAM C78448
Poecilasmatidae	*Glyptelasma orientale*	9	130	1	WAM C82324
Poecilasmatidae	*Megalasma minus*	18	133	1	WAM C77902
Poecilasmatidae	*Megalasma minus*	18	133	1	WAM C77903
Poecilasmatidae	*Megalasma minus*	5	161	1	WAM C77909
Poecilasmatidae	*Megalasma minus*	16	107	1	WAM C77916
Poecilasmatidae	*Megalasma minus*	16	107	1	WAM C78438
Poecilasmatidae	*Megalasma minus*	18	107	4	WAM C78441
Poecilasmatidae	*Megalasma minus*	18	107	1	WAM C78601
Poecilasmatidae	*Megalasma minus*	5	161	10	WAM C82325
Poecilasmatidae	*Megalasma minus*	18	133	13	WAM C82326
Poecilasmatidae	*Megalasma minus*	193	120	2	WAM C80026
Poecilasmatidae	*Megalasma minus*	193	120	1	WAM C80027
Poecilasmatidae	*Megalasma minus*	193	120	1	WAM C80028
Poecilasmatidae	*Megalasma minus*	193	120	1	WAM C80029
Poecilasmatidae	*Megalasma minus*	128	149	3	WAM C82265
Poecilasmatidae	*Megalasma minus*	163	117	5	WAM C82266
Poecilasmatidae	*Megalasma minus*	193	119	1	WAM C82267
Poecilasmatidae	*Poecilasma kaempferi*	35	129	1	WAM C77905
Poecilasmatidae	*Poecilasma kaempferi*	35	129	1	WAM C77906
Poecilasmatidae	*Poecilasma kaempferi*	35	129	2	WAM C78506
Poecilasmatidae	*Poecilasma kaempferi*	48	134	1	WAM C78539
Poecilasmatidae	*Poecilasma kaempferi*	105	128	3	WAM C82268
Poecilasmatidae	*Rhizolepas* sp. 1	28	134	1	WAM C77917
Poecilasmatidae	*Rhizolepas* sp. 1	28	130	1	WAM C78469
Poecilasmatidae	*Rhizolepas* sp. 1	28	131	3	WAM C78470

Family	Species	Operation	Accession no.	Specimen no.	Registration no.*
Poecilasmatidae	*Rhizolepas* sp. 1	28	132	2	WAM C78471
Poecilasmatidae	*Rhizolepas* sp. 1	28	134	2	WAM C78472
Poecilasmatidae	*Rhizolepas* sp. 1	28	171	1	WAM C78481
Scalpellidae	*Amigdoscalpellum* cf. *manum*	181	135	1	WAM C82269
Scalpellidae	*Amigdoscalpellum* elegans	40	102	1	WAM C78519
Scalpellidae	*Amigdoscalpellum* elegans	40	135	5	WAM C78523
Scalpellidae	*Amigdoscalpellum* elegans	46	108	3	WAM C78526
Scalpellidae	*Amigdoscalpellum* elegans	40	102	1	WAM C78593
Scalpellidae	*Amigdoscalpellum* elegans	103	134	1	WAM C80034
Scalpellidae	*Amigdoscalpellum* elegans	103	134	1	WAM C80035
Scalpellidae	*Amigdoscalpellum* vitreum	33	135	1	WAM C78503
Scalpellidae	*Amigdoscalpellum* vitreum	46	108	1	WAM C78592
Scalpellidae	*Amigdoscalpellum* vitreum	115	152	1	WAM C80019
Scalpellidae	*Amigdoscalpellum* vitreum	115	153	1	WAM C80020
Scalpellidae	*Amigdoscalpellum* vitreum	147	119	1	WAM C80023
Scalpellidae	*Amigdoscalpellum* vitreum	191	122	1	WAM C82270
Scalpellidae	*Anguloscalpellum* sp. nov.	128	116	2	WAM C82271
Scalpellidae	*Anguloscalpellum* sp. nov.	128	152	1	WAM C82272
Scalpellidae	*Arcoscalpellum* cf. *angularum*	122	156	1	WAM C80010
Scalpellidae	*Arcoscalpellum michelottianum*	5	132	1	WAM C78406
Scalpellidae	*Arcoscalpellum michelottianum*	26	112	4	WAM C78458
Scalpellidae	*Arcoscalpellum michelottianum*	26	143	1	WAM C78468
Scalpellidae	*Arcoscalpellum michelottianum*	31	127	1	WAM C78486
Scalpellidae	*Arcoscalpellum michelottianum*	37	124	2	WAM C78512
Scalpellidae	*Arcoscalpellum michelottianum*	37	158	1	WAM C78518
Scalpellidae	*Arcoscalpellum michelottianum*	31	127	1	WAM C78596
Scalpellidae	*Arcoscalpellum michelottianum*	26	112	1	WAM C78597
Scalpellidae	*Arcoscalpellum michelottianum*	105	114	1	WAM C82274
Scalpellidae	*Arcoscalpellum michelottianum*	105	115	2	WAM C82275
Scalpellidae	*Arcoscalpellum michelottianum*	113	119	1	WAM C82276
Scalpellidae	*Arcoscalpellum michelottianum*	113	169	1	WAM C82277
Scalpellidae	*Arcoscalpellum michelottianum*	113	170	1	WAM C82278
Scalpellidae	*Arcoscalpellum michelottianum*	116	112	1	WAM C82279
Scalpellidae	*Arcoscalpellum michelottianum*	116	117	1	WAM C82280
Scalpellidae	*Arcoscalpellum michelottianum*	117	123	1	WAM C82281
Scalpellidae	*Arcoscalpellum michelottianum*	117	124	4	WAM C82282
Scalpellidae	*Arcoscalpellum michelottianum*	131	139	1	WAM C82283
Scalpellidae	*Arcoscalpellum michelottianum*	131	140	5	WAM C82284
Scalpellidae	*Arcoscalpellum michelottianum*	147	121	1	WAM C82285
Scalpellidae	*Arcoscalpellum michelottianum*	147	120	1	WAM C82286
Scalpellidae	*Arcoscalpellum michelottianum*	153	104	3	WAM C82287
Scalpellidae	*Arcoscalpellum michelottianum*	155	118	2	WAM C82288
Scalpellidae	*Arcoscalpellum michelottianum*	181	135	2	WAM C82289
Scalpellidae	*Arcoscalpellum michelottianum*	187	112	1	WAM C82290
Scalpellidae	*Arcoscalpellum michelottianum*	189	108	5	WAM C82291
Scalpellidae	*Arcoscalpellum sculptum*	145	144	1	WAM C80030
Scalpellidae	*Arcoscalpellum sculptum*	145	144	1	WAM C80031
Scalpellidae	*Arcoscalpellum sculptum*	120	176	1	WAM C82292
Scalpellidae	*Arcoscalpellum truncatum*	147	119	1	WAM C80024
Scalpellidae	*Arcoscalpellum truncatum*	145	144	1	WAM C80032
Scalpellidae	*Catherinum australicum*	145	144	1	WAM C80033
Scalpellidae	*Catherinum constrictum*	181	135	1	WAM C82294
Scalpellidae	*Catherinum trapezoideum*	151	149	1	WAM C80018
Scalpellidae	*Litoscalpellum* sp. 1	31	127	1	WAM C82327
Scalpellidae	*Litoscalpellum* sp. 1	31	128	1	WAM C78487
Scalpellidae	*Litoscalpellum* sp. 1	116	128	1	WAM C82295
Scalpellidae	*Neoscalpellum* cf. *marginatum*	26	111	1	WAM C78457
Scalpellidae	*Neoscalpellum* cf. *marginatum*	28	164	2	WAM C78478

Family	Species	Operation	Accession no.	Specimen no.	Registration no.*
Scalpellidae	*Neoscalpellum* cf. *marginatum*	28	165	1	WAM C78479
Scalpellidae	*Neoscalpellum* cf. *marginatum*	31	126	1	WAM C78485
Scalpellidae	*Neoscalpellum* cf. *marginatum*	31	129	1	WAM C78488
Scalpellidae	*Neoscalpellum* cf. *marginatum*	37	123	1	WAM C78511
Scalpellidae	*Neoscalpellum* cf. *marginatum*	151	149	1	WAM C80016
Scalpellidae	*Neoscalpellum* cf. *marginatum*	151	149	1	WAM C80017
Scalpellidae	*Neoscalpellum* cf. *marginatum*	122	159	1	WAM C82296
Scalpellidae	*Neoscalpellum* cf. *marginatum*	181	135	1	WAM C82297
Scalpellidae	*Neoscalpellum* cf. *marginatum*	116	113	1	WAM C82298
Scalpellidae	*Planoscalpellum* sp. 1	147	121	1	WAM C82299
Scalpellidae	*Regioscalpellum gigas*	7	106	1	WAM C78411
Scalpellidae	*Regioscalpellum gigas*	122	156	3	WAM C80011
Scalpellidae	*Trianguloscalpellum hirsutum*	147	119	1	WAM C80025
Scalpellidae	*Trianguloscalpellum* sp. 1	40	102	1	WAM C78594
Verrucidae	*Altiverruca casula*	9	130	1	WAM C78421
Verrucidae	*Altiverruca casula*	155	137	4	WAM C82300
Verrucidae	*Altiverruca* sp. 1	153	145	3	WAM C82301
Verrucidae	*Altiverruca* sp. 1	31	130	1	WAM C78489
Verrucidae	*Altiverruca* sp. 1	147	118	19	WAM C80038
Verrucidae	*Altiverruca* sp. 1	147	118	1	WAM C80039
Verrucidae	*Altiverruca* sp. 1	124	156	1	WAM C82302
Verrucidae	*Altiverruca* sp. 1	124	157	1	WAM C82303
Verrucidae	*Altiverruca* sp. 1	159	150	10	WAM C82304
Verrucidae	*Altiverruca* sp. 1	105	191	1	WAM C82305
Verrucidae	*Altiverruca* sp. 1	105	192	5	WAM C82306
Verrucidae	*Altiverruca* sp. 1	108	151	1	WAM C82307
Verrucidae	*Altiverruca* sp. 1	147	117	1	WAM C82308
Verrucidae	*Cameraverruca* sp. 1	37	125	1	WAM C77911
Verrucidae	*Cameraverruca* sp. 1	37	125	2	WAM C78513
Verrucidae	*Cameraverruca* sp. 1	136	123	2	WAM C80037
Verrucidae	*Cameraverruca* sp. 1	113	207	3	WAM C82309
Verrucidae	*Cameraverruca* sp. 1	113	173	1	WAM C82310
Verrucidae	*Costatoverruca* sp. 1	163	116	15	WAM C82311
Verrucidae	*Gibbosaverruca nitida*	46	114	1	WAM C78527
Verrucidae	*Gibbosaverruca nitida*	153	136	1	WAM C82312
Verrucidae	*Gibbosaverruca sulcata*	26	110	1	WAM C77910
Verrucidae	*Gibbosaverruca sulcata*	26	110	3	WAM C78456
Verrucidae	*Gibbosaverruca sulcata*	143	167	1	WAM C80036
Verrucidae	*Gibbosaverruca sulcata*	124	127	1	WAM C82313
Verrucidae	*Gibbosaverruca sulcata*	126	142	36	WAM C82314
Verrucidae	*Gibbosaverruca sulcata*	126	168	8	WAM C82315
Verrucidae	*Gibbosaverruca sulcata*	136	147	5	WAM C82316
Verrucidae	*Gibbosaverruca sulcata*	136	170	3	WAM C82317
Verrucidae	*Gibbosaverruca sulcata*	141	170	1	WAM C82318
Verrucidae	*Gibbosaverruca sulcata*	157	119	2	WAM C82319
Verrucidae	*Metaverruca* sp. 1	44	102	1	WAM C77912
Verrucidae	*Metaverruca* sp. 1	44	102	1	WAM C77913
Verrucidae	*Metaverruca* sp. 1	44	102	4	WAM C78524
Verrucidae	*Metaverruca* sp. 2	124	128	8	WAM C82320
Verrucidae	*Metaverruca* sp. 2	126	141	3	WAM C82321
Verrucidae	*Metaverruca* sp. 2	161	167	20	WAM C82322
Verrucidae	*Metaverruca* sp. 2	165	137	7	WAM C82323
Verrucidae	*Metaverruca* sp. 2	37	125	1	WAM C78598
Verrucidae	*Newmaniverruca* sp. 1	22	109	2	WAM C78447
Verrucidae	*Newmaniverruca* sp. 1	22	109	1	WAM C77914

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